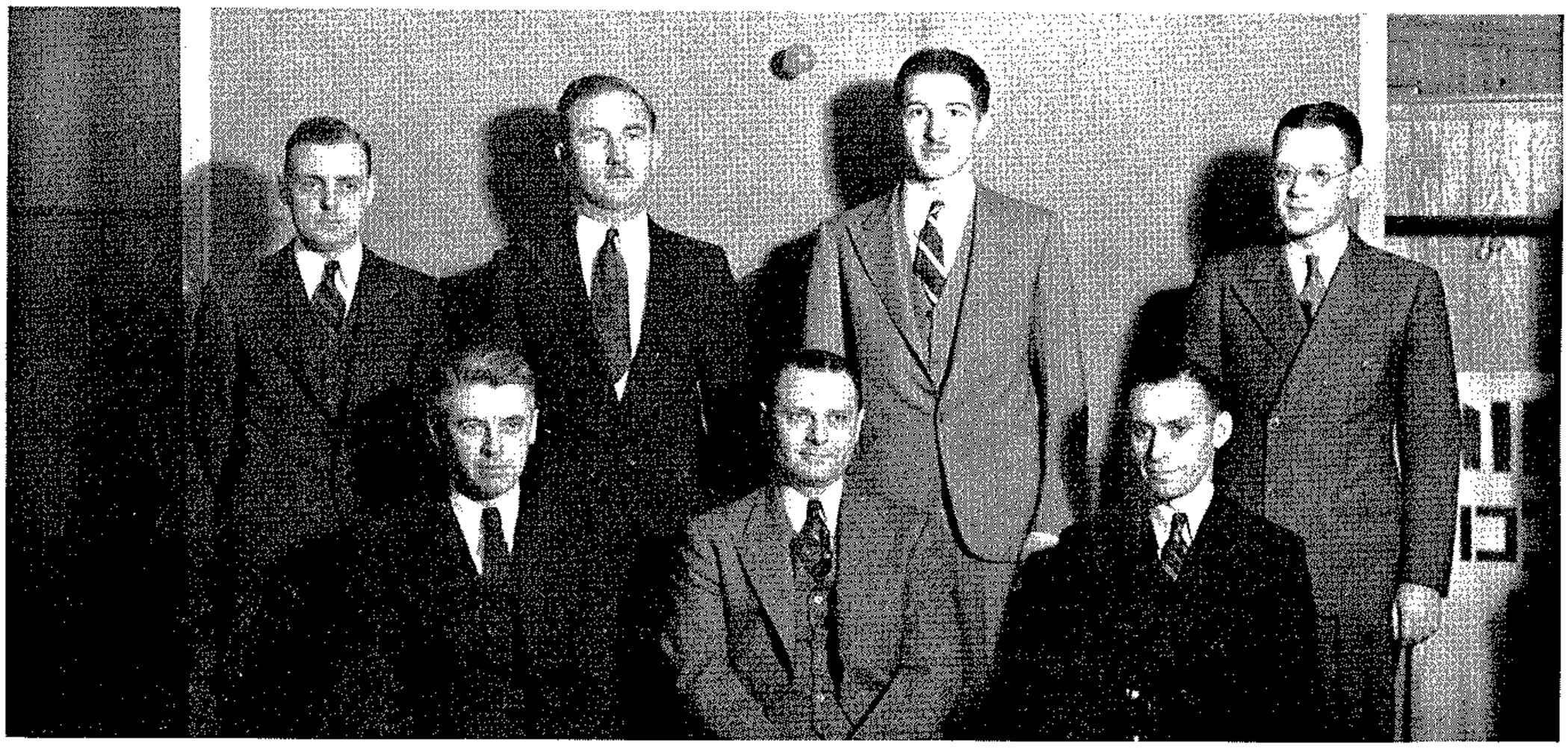
THORDARSON

THORDARSON
ELEC. MFG. CO.
CHICAGO

No. 344-A

TRANSMITTER GUIDE

Price 15c



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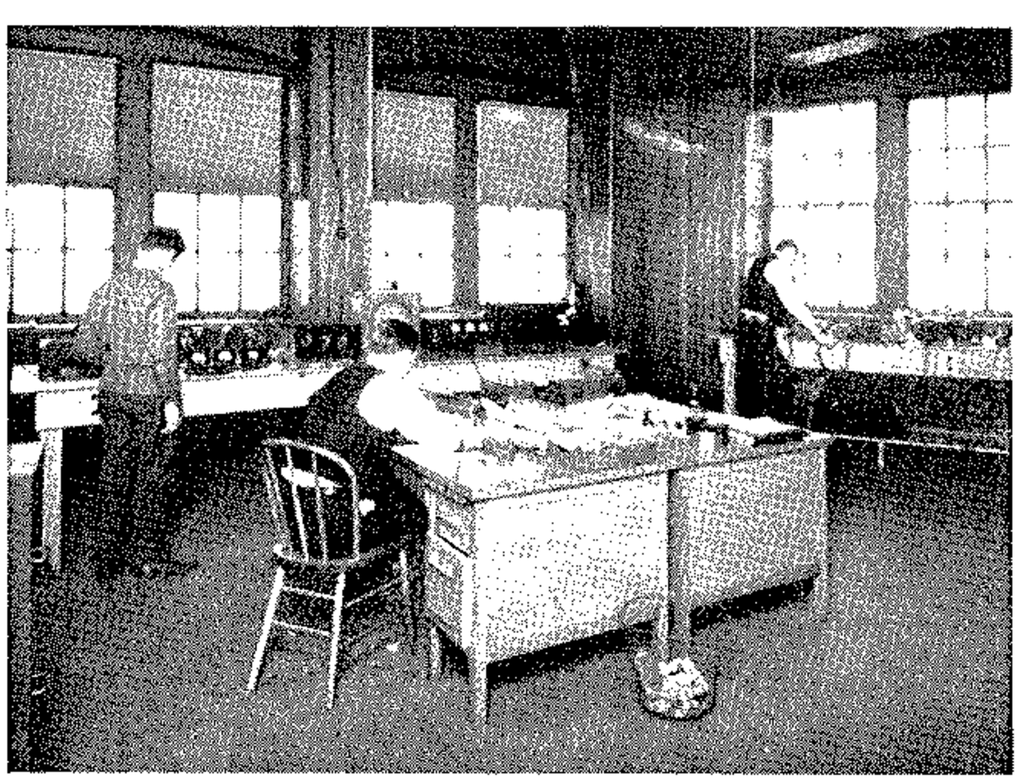
THORDARSON is the largest and the most experienced organization in the world engaged exclusively in the manufacture of transformers. This 40-year old concern has established an international reputation for dependable products and the distinctive THORDARSON trademark will be found on transmitters and other radio equipment throughout the world.

Behind the name THORDARSON stands the experience of a seasoned and practical technical staff of acknowledged leaders and unequaled research and manufacturing facilities.

THORDARSON engineers are themselves amateurs operating their own transmitters and are thoroughly familiar with the amateur's problems. The complete THORDARSON line of more than 130 transmitting transformers was developed under the direct supervision of these men.

THORDARSON maintains two large and well-equipped laboratories. A production laboratory is devoted to factory testing, service, drafting, and the development of transformers for general production. A research laboratory, entirely independent of the production laboratory, is devoted to the development of new models and new circuits.

THORDARSON offers the most complete line of transmitter transformers designed to fit every application. The THORDARSON engineering staff will be happy to give their personal attention to any of your transformer problems.



The well-equipped THORDARSON Research Laboratory devoted exclusively to development and research.

The THORDARSON Factory—the largest plant in the world devoted exclusively to the manufacture of transformers.

THORDARSON « « TRANSMITTER GUIDE

No. 344-A

THE enthusiasm with which the first edition of the THORDARSON Transmitter Guide was received has been a great incentive to THORDARSON engineers in the preparation of this new and enlarged edition.

The Transmitter Guide—itself only one of the component parts of the complete THORDARSON Transformer Manual—is not offered as a text book on transmitting circuits, nor as an all-inclusive transmitting handbook. Rather, it is a compilation of the newer transmitting circuits, embodying advanced principles and utilizing the newer tubes, and is intended to provide the operating radio amateur with practical information and diagrams on the latest circuits.

The circuits presented herein have been carefully worked out by THORDARSON engineers—themselves experienced "hams." Complete data for all power requirements is given, assuring thoroughly matched components. While every recent circuit refinement of proven value has been incorporated, care has been taken to eliminate developments of questionable value or dependability.

In response to many requests, this enlarged Transmitter Guide contains several "old faithful" circuits which have long been popular. Material on fundamental transmitter circuits has also been included to permit a better understanding of the complete diagrams and to assist in original circuit design. The complete transmitters are rated in wattage input to the final stage, and for convenience, a suggested modulator unit is shown with each r.f. unit. Of course many additional combinations are possible.

A new graph is shown on page 30 for more easily determining wattage input, as well as load impedance values, so the modulators may be properly matched to the modulated tubes. The tube characteristic tables and the base connection chart are a great convenience, and all tubes commonly used in amateur transmitters are included.

THORDARSON engineers are deeply indebted to the many leading amateurs and transmitting equipment engineers who so generously contributed their suggestions and active cooperation in the preparation of this Transmitter Guide. It is hoped the material contained in these pages will prove of value to every reader.

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Fundamental Transmitter Circuits

OSCILLATORS

There are two types of oscillators used in amateur transmitters: the self-controlled type, in which the frequency of the oscillations generated is dependent upon the electrical constants of the circuit; and the crystal-controlled type, in which the physical constants of the controlling crystal determine the oscillator frequency. The self-controlled oscillators can employ either inductive or capacitive coupling to feed back energy from the plate to the grid circuit.

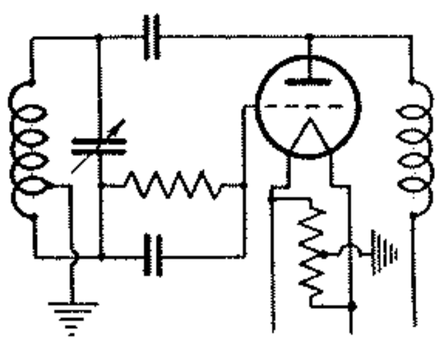


Fig. 1. Hartley Oscillator

The Hartley oscillator, shown in Fig. 1, is a very popular self-controlled circuit employing inductive feed-back. With this circuit High-C (high capacity) is used in order to obtain stability and minimize frequency drift. The tuned-plate tuned-grid oscillator circuit is shown in Fig. 2. At the higher frequencies, the plate tank circuit and the grid tank circuit are not inductively coupled, the capacity of the tube providing feed-back. Like the Hartley oscillator, the tuned-plate tuned-grid oscillator requires a High-C tank circuit for stability.

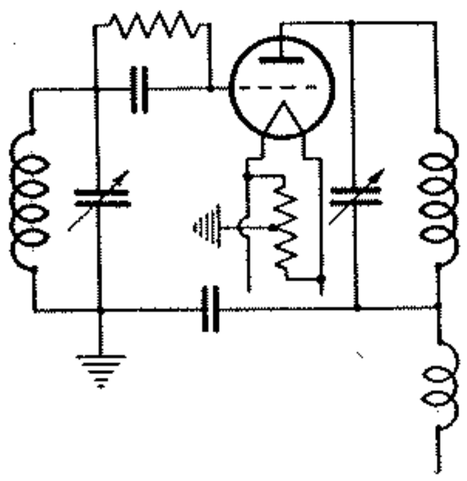


Fig. 2. Tuned-Plate Tuned-Grid Oscillator

A crystal-controlled oscillator, using the type 47, which is probably the best crystal oscillator tube known today, is shown in Fig. 3. Plate voltages of 350 to 400 can be carried with less radio frequency current through the crystal than with triodes operating at lower voltages. The screen voltage should be between 90 and 125 volts for best operation, and the screen should be by-passed to ground through a condenser of .01 mfd. or larger. The grid leak can consist of a 2-watt carbon resistor of 10,000 to 25,000 ohms. The plate tank circuit is Low-C, a 100 mfd. condenser being quite satisfactory.

Tubes can be used in push-pull as oscillators, as shown in Fig. 4. The regular tuned-plate tuned-grid circuit is used, but instead of tuning the grid circuit with a condenser, the coil is designed to resonate at the desired frequency. For crystal control the electrodes of the crystal holder are connected to the two grids, and in place of the grid coil, a center tapped radio frequency choke is used. The grid coil can be adjusted so the oscillator can be tuned over quite a band by means of the split-section condenser in the plate circuit.

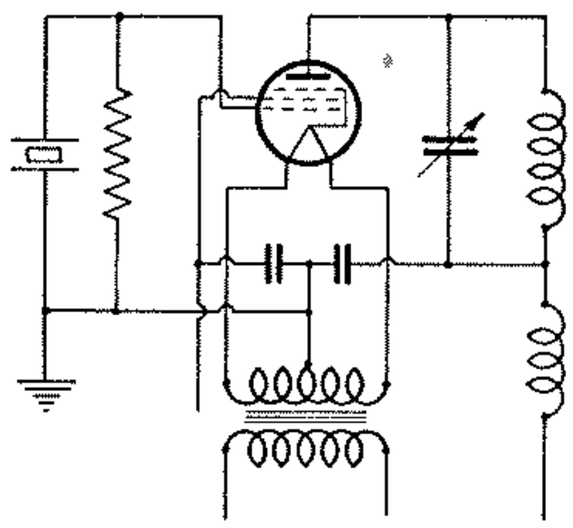


Fig. 3. Crystal-Controlled Oscillator using 47 Tube

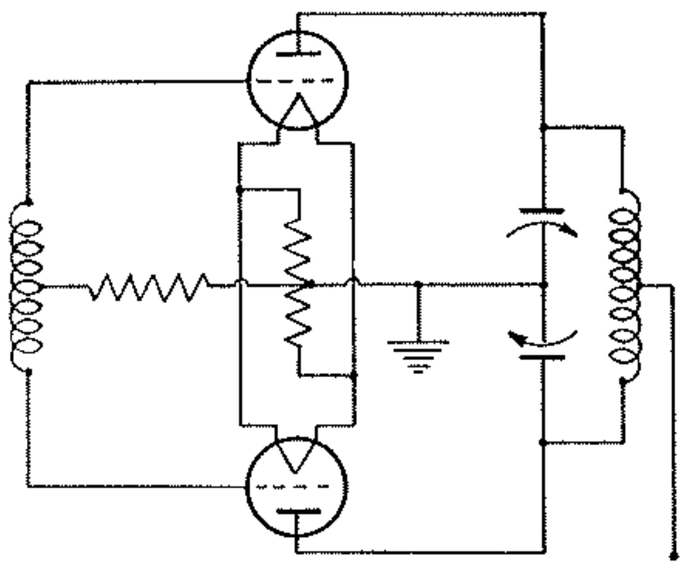


Fig. 4. Push-Pull Oscillator

The tri-tet is the latest development in oscillator circuits and is gaining wide popularity because of its stability and high harmonic output. Fig. 5 shows the electron-coupled circuit, and Fig. 6 the crystal-controlled circuit. The grid tank circuit is High-C and the plate tank circuit Low-C. In operation the plate circuit is tuned to a harmonic of the grid circuit for maximum stability.

AMPLIFIERS

To prevent variations in load on the amplifier from affecting the oscillator frequency, as in keying or modulation, it is modern practice to use buffer stages between the oscillator and the amplifier stage feeding the antenna. The buffer amplifiers also furnish the additional r.f. gain needed to properly excite the highly biased Class C amplifier tubes.

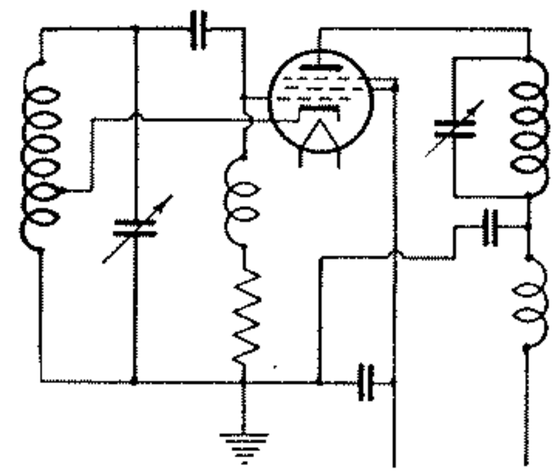


Fig. 5. Electron-Coupled Tri-Tet Oscillator

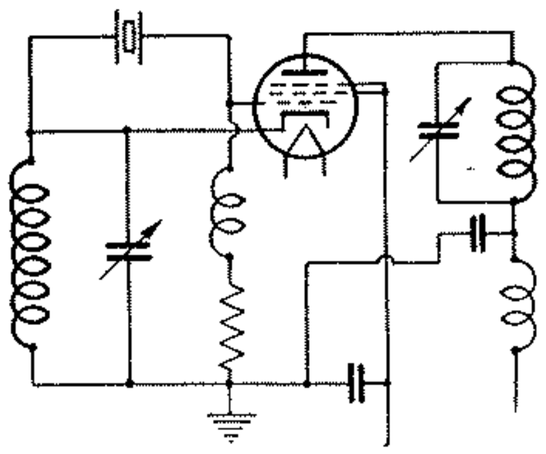


Fig. 6. Crystal-Controlled Tri-Tet Oscillator

Fig. 7 shows the conventional neutralized buffer amplifier stage. Fig. 8 shows the screen-grid amplifier. Both are coupled through condensers to the preceding stage.

Fig. 9 shows the buffer amplifier with link coupling to the preceding stage. In this circuit the grid is tuned and a coupling line is used to carry the energy from the exciting stage. From an efficiency standpoint, it is

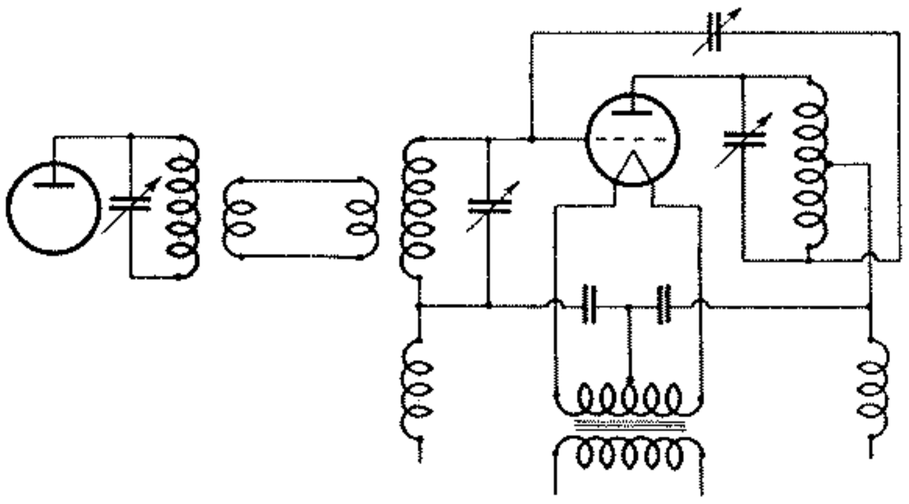


Fig. 9. Buffer Amplifier with Link Coupling to Preceding Stage

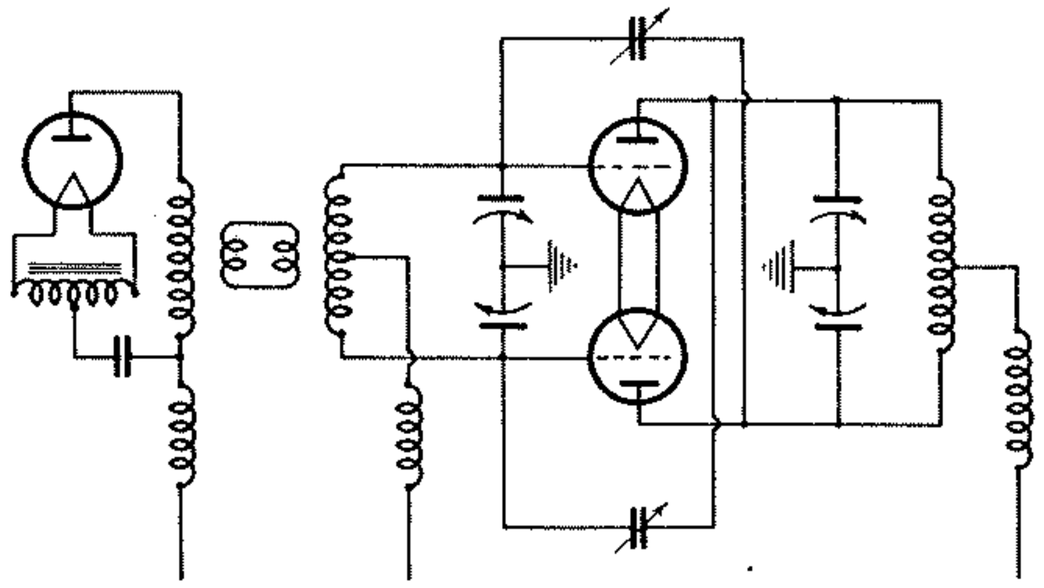


Fig. 11. Push-Pull Amplifier Link Coupled to a Single Stage

far superior to the condenser system of coupling. The value of the grid choke is not critical. The main disadvantage of this circuit is that an additional tuning condenser is required. This condenser, however, can be eliminated by interwinding the grid and plate coils, as shown in Fig. 10.

Fig. 11 shows the method of coupling a single stage to a push-pull amplifier stage. Split-section condensers are used, and the

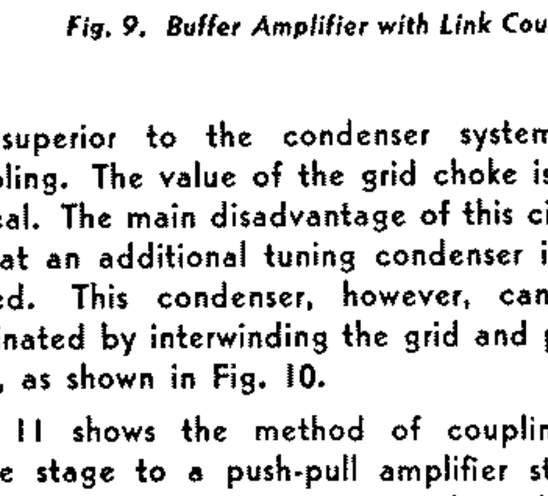


Fig. 7. Neutralized Buffer Amplifier Stage

rotors are grounded. Fig. 12 shows a single stage capacitively coupled to a push-pull amplifier stage.

FREQUENCY DOUBLERS

The circuit for a frequency doubler is the same as that of the buffer amplifier, the difference being in the bias voltage. In the

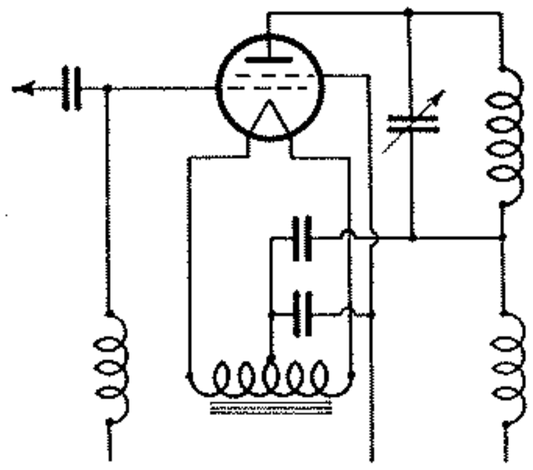


Fig. 8. Screen-Grid Buffer Amplifier Stage

popular distortion type of doubler, the bias is from 3 to 7 times cut off. Naturally, considerable r.f. voltage is needed to drive this type of doubler, and efficiency is quite low. The push-pull, or push-push doubler—which is becoming quite popular—is shown in Fig. 13. The grids are in push-pull, but the plates are in parallel. In operation the grids receive excitations on each half of the cycle, and as the plates are in parallel, the impulses delivered to the plate tank are all in one direction, or double the frequency of the grid circuit. The efficiency is better than the distortion type doubler, the output being about the same as can be obtained with a single tube as a straight amplifier. When it is desired to operate the stage as a straight amplifier, it is only necessary to change the

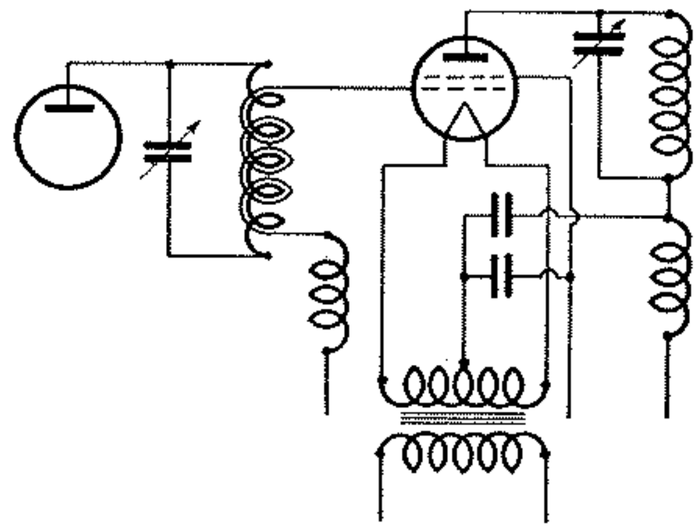


Fig.10. Buffer Amplifier Coupled by Interwinding Coils

plate coil and open the filament circuit of one of the tubes. This tube then neutralizes the other, assuming, of course, that the two tubes have about the same characteristics.

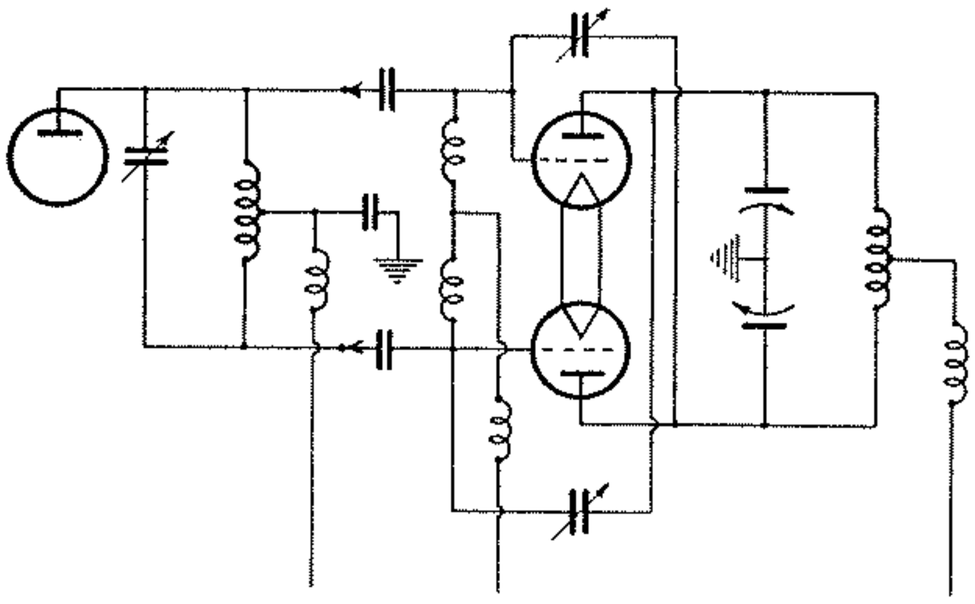


Fig. 12. Single Stage Capacitively Coupled to a Push-Pull Amplifier Stage

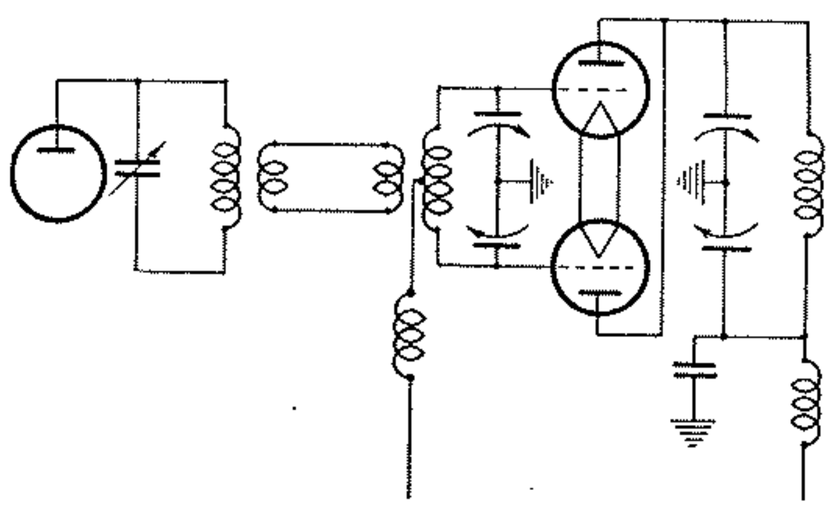


Fig. 13. Push-Pull Frequency Doubler

1-KW. Transmitter « « Push-Pull 204A's

One kilowatt input for C.W. or phone is the maximum power allowed amateur stations. In this high-powered transmitter a crystal oscillator and two buffer stages guarantee frequency stability and ample excitation. The power supply systems are designed to allow continuous operation at full power input. Separate filament transformers for each stage permit the use of meters in center taps at ground potential, so a metal frame can be used. In the circuit they are shown in the high voltage leads.

For 100% modulation, either two 204A's in Class B or push-pull parallel 203A's in Class B can be used. Complete diagrams are shown for both 204A's and the four 203A's. If the modulator unit is to be separate from the speech equipment, T-6167 should be used to couple the push-pull 845 drivers to a 500-ohm line, T-6429 for coupling the 500-ohm line to the 204A grids, or T-6734 to push-pull parallel 203A grids. This system is recommended for best results, as it separates the high power output circuit from the input circuit. The 18-watt speech amplifier shown on pages 20 and 21 will amply drive the four 203A's in Class B.

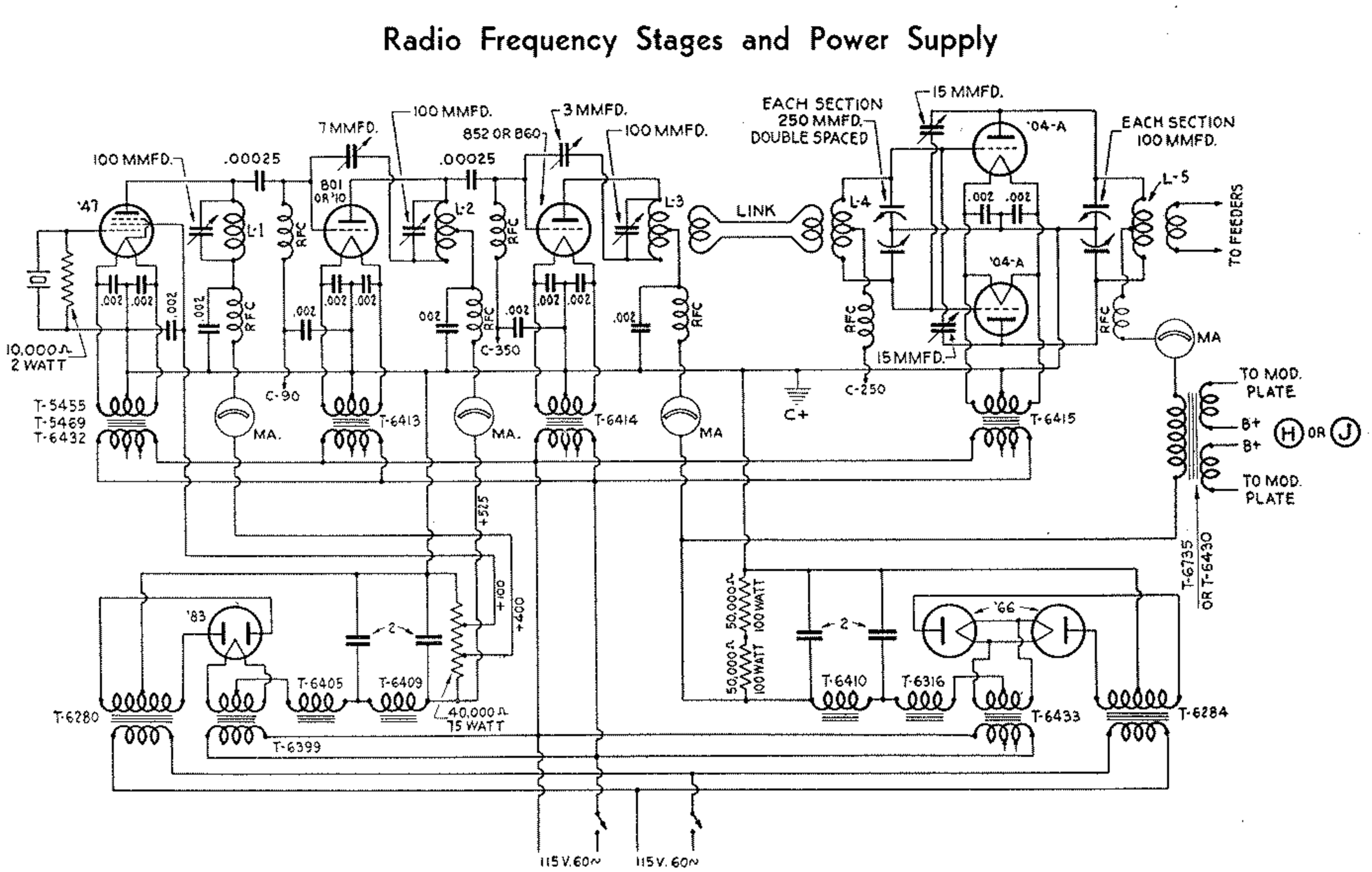
Specifications are not given for the link circuit because of the variations in individual layouts. The coupling coils can be placed at the center of L3 and L4, or each link may be wound in two sections and coupled at the ends of L3 and L4. Turns and coupling should be adjusted for maximum grid current of the 204A's at rated plate current of the 852 or 860 buffer stage.

The audio voltage developed across the secondary of the Class B output transformer runs into thousands of volts and may break down the insulation of the transformer if full power is turned on without a secondary load. For this reason, the modulator unit should be turned on after the R.F. end is in operation.

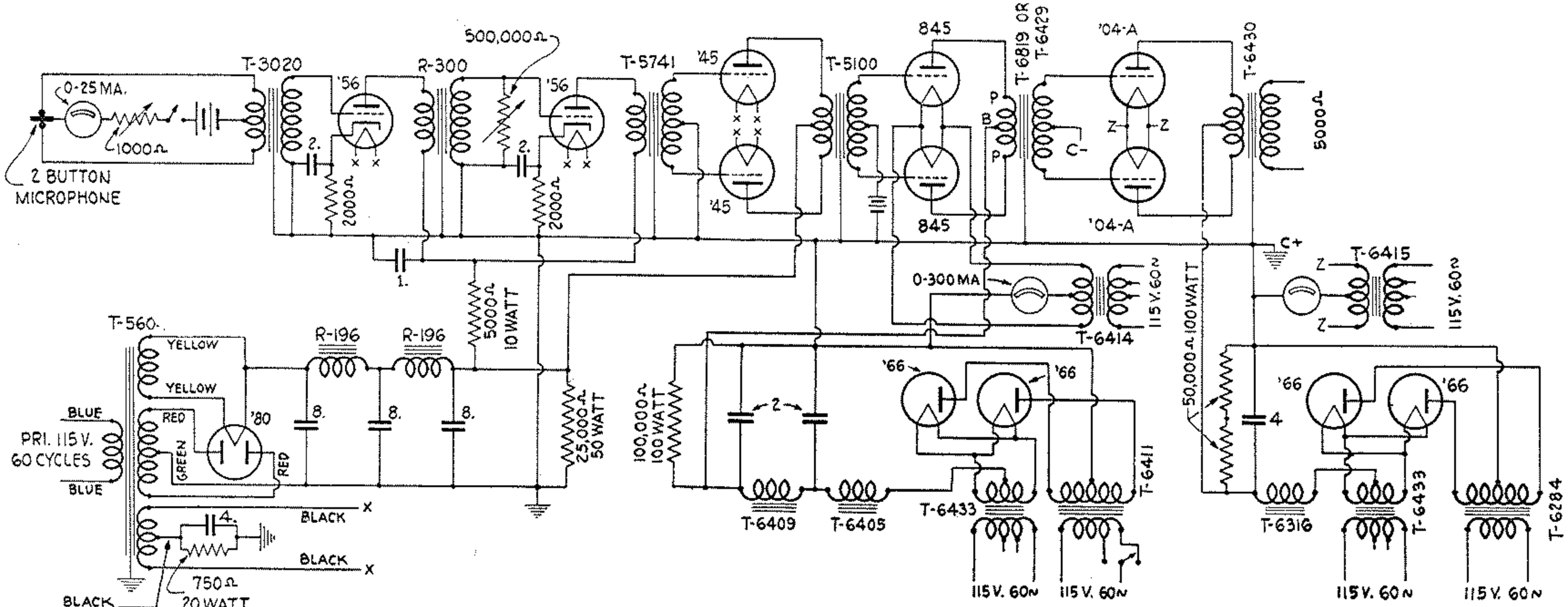
Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding		
				3500 KC.	7000 KC.	14,000 KC.
L1	3"	No. 14 Enameled	8	3"	1"	
L2	3"	No. 14 Enameled	8	3"	1"	½"
L3	4"	THORDARSON Ind.		T-7053	T-7052	T-7051
L4	4"	THORDARSON Ind.		T-7053	T-7052	T-7051
Link		See Text				

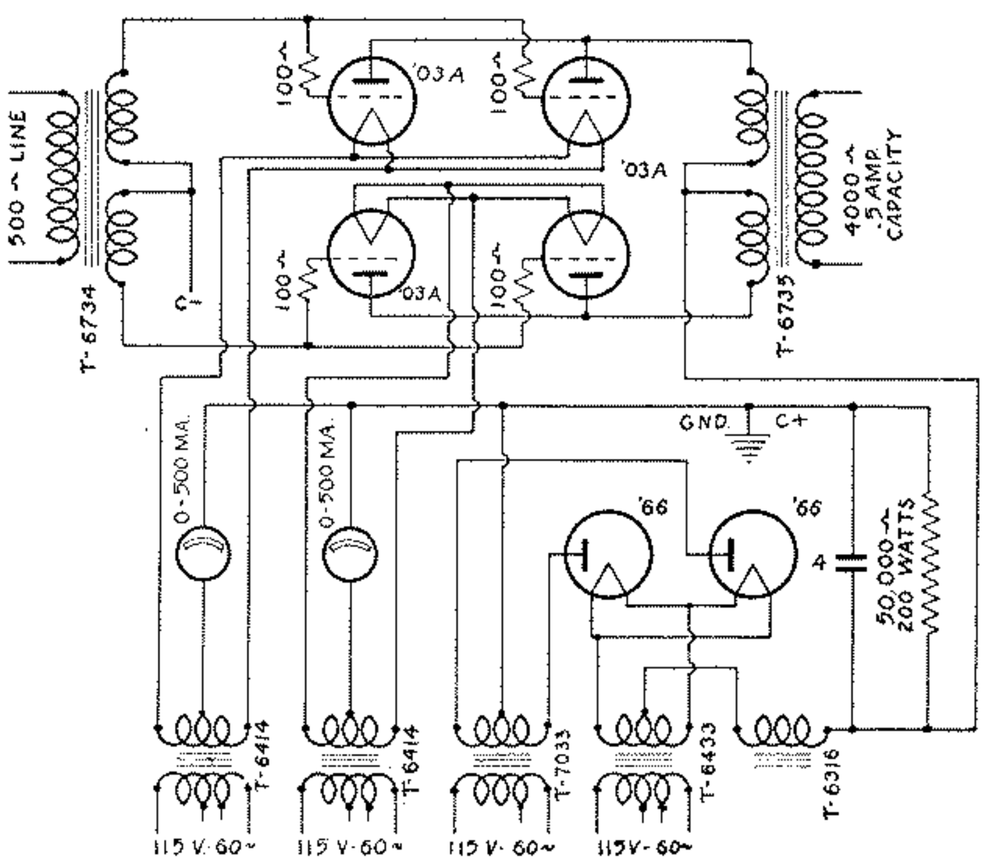
Radio Frequency Stages and Power Supply



Modulator and Speech Amplifier "J"



Modulator and Speech Amplifier "H"



THORDARSON Equipment in 1-KW. Transmitter

Mod. and Sp. Amplifier "H"

T-6316 Input Choke
T-6433 Filament Transformer
T-7033 Plate Transformer
T-6414 Filament Transformer (two)
T-6734 Input Transformer
T-6735 Output Transformer

Radio Frequency Stages

T-5455, T-5469, or T-6432 Filament Transformers
T-6413 Filament Transformer
T-6414 Filament Transformer
T-6415 Filament Transformer
T-6280 Plate Transformer
T-6399 Filament Transformer
T-6405 Input Choke
T-6409 Filter Choke
T-6284 Plate Transformer
T-6433 Filament Transformer
T-6316 Input Choke
T-6410 Filter Choke

Mod. and Sp. Amplifier "J"

T-6284 Plate Transformer
T-6433 Filament Transformer (two)
T-6316 Input Choke
T-6415 Filament Transformer
T-6414 Filament Transformer
T-6411 Plate Transformer
T-6405 Input Choke
T-6409 Filter Choke
T-5604 Plate and Filament Transformer
R-196 Filter Choke (two)
T-3020 Microphone Transformer
R-300 Interstage Transformer
T-5741 Push-Pull Input Transformer
T-5100 Push-Pull Interstage Transformer
T-6819 or T-6429 Class B Input Transformer
T-6430 Class B Output Transformer

200-Watt Transmitter » » Push-Pull 800's

This C.W. and Phone Transmitter was built and tested by the Headquarters Technical Staff of the Amateur Radio Relay League, and uses the latest type tubes with THORDARSON Transformers throughout. It is now in use maintaining communication on regular schedules with amateurs in this country and abroad.

The tubes used permit efficient operation on all wave bands, and maximum input is possible even at frequencies as high as 30 megacycles. The transmitter uses two type 800 tubes in push-pull in the output stage, which are driven by an 841 buffer, preceded by a 59 doubler and a 59 tri-tet oscillator. The circuit is self-biased throughout, and no batteries are needed.

A jack and plug arrangement is used for reading plate and grid currents in all R.F. and audio stages.

A pair of 66 rectifiers, supplied by a T-6411 Plate Transformer and a T-6433 Filament Transformer, provide power to the 800 stage. A T-6315 Input Choke and a T-6408 Smoothing Choke are used in the filter circuit.

Power for the preceding stages is supplied by a T-6280 Plate Transformer and rectified by an 83 tube. A T-6405 Input Choke and T-6509 Filter Choke effectively smooth the rectifier output. All R.F. stage filaments are supplied by the T-6417 Multiple Winding Filament Transformer.

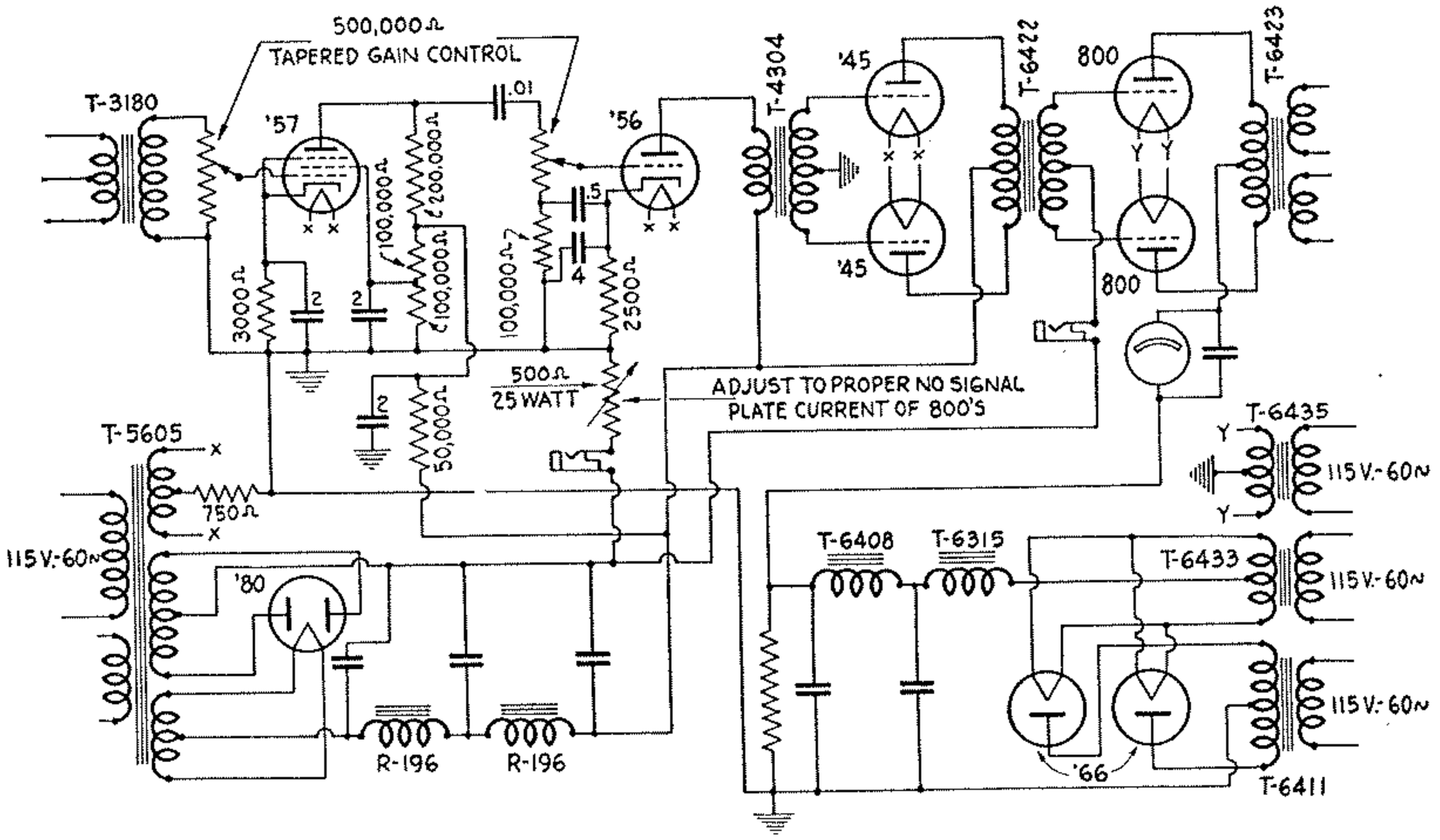
The speech amplifier and modulator unit has a pair of type 800 tubes in the final stage, which are driven by two type 245's preceded by a single type 56 stage and single type 57 stage. No battery bias is required, as the Class B modulators are biased from the preamplifier supply. The center tap of the T-6435 Transformer is grounded to complete the circuit.

A single plate supply transformer, T-7033, can be used, with T-6316 and T-6410 chokes, in place of the two T-6411 transformers. This would eliminate one complete power supply and reduce the cost considerably.

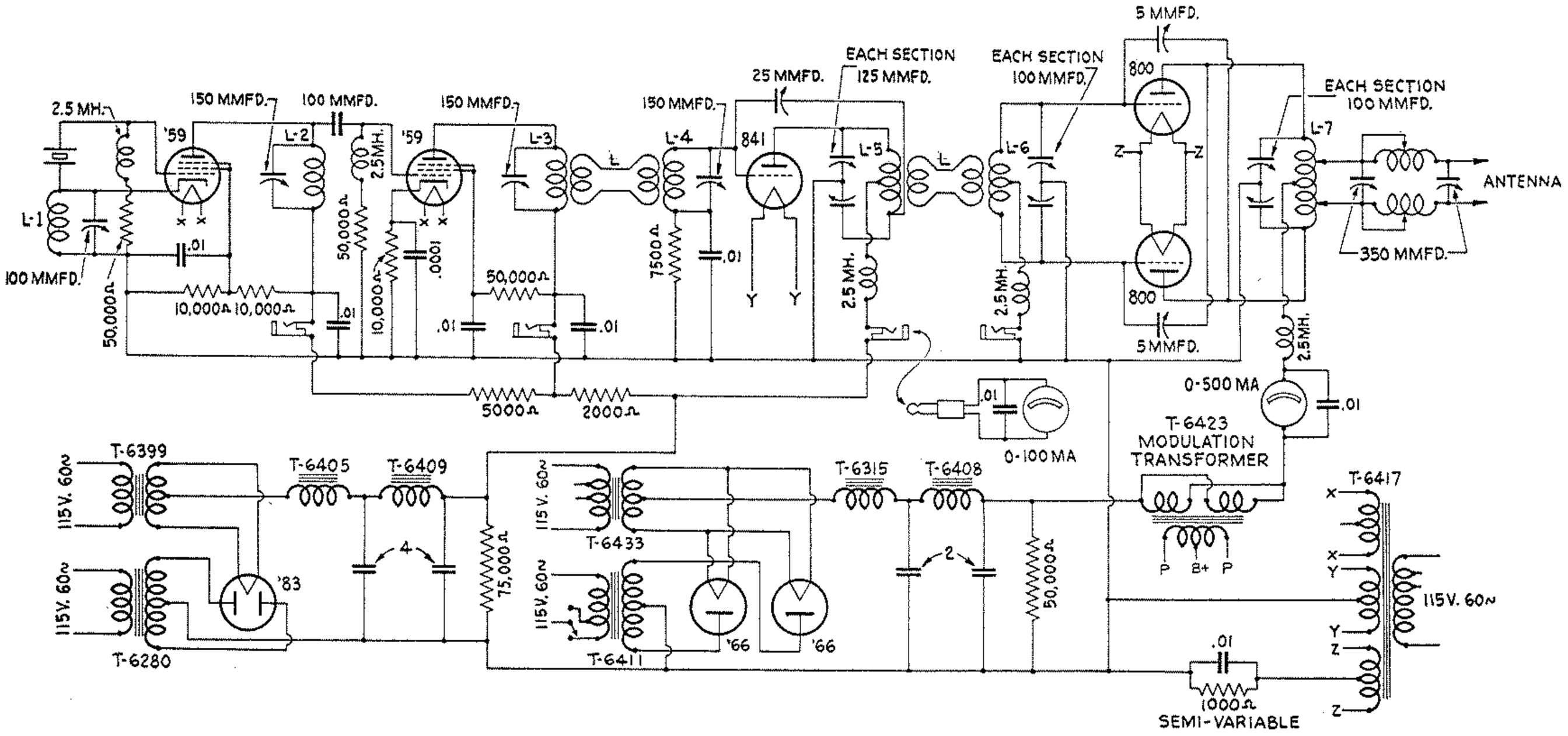
This transmitter is similar to the one used at W9USA during the World's Fair at Chicago, and which was heard in practically all parts of the world (see photographs on page 14). It is easily adapted to relay rack construction, one rack being used for the radio frequency section and its power supply and another rack for the speech amplifier, modulators, and power supplies.

The THORDARSON equipment listed is designed to supply rated voltage at continuous service. All other parts used in this transmitter should be selected with great care.

Modulator and Speech Amplifier



Radio Frequency Stages and Power Supply



THORDARSON Equipment for 200-Watt Transmitter

T-6423	Modulation Transformer
T-5605	Combination Plate and Filament Transformer
T-6435	Filament Transformer
R-196	Choke (two)
T-3180	Microphone Transformer
T-4304	Push-Pull Input Transformer
T-6422	Class B Input Transformer
T-6280	Plate Transformer
T-6399	Filament Transformer
T-6405	Input Choke
T-6409	Filter Choke
T-6417	Multiple Secondary Filament Transformer
T-6411	Plate Transformer (two)
T-6433	Filament Transformer (two)
T-6315	Input Choke (two)
T-6408	Filter Choke (two)

Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding 1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	1¼"	No. 22 S.S.C.	36	3"	1¼"	½"	
L2	2"	No. 18 S.S.C.	23	2¾"	1"	½"	¼"
L3	2"	No. 18 S.S.C.	23	2¾"	1"	½"	¼"
L4	2"	No. 18 S.S.C.	23	2¾"	1"	½"	¼"
L5	3"	No. 14 Enameled	8	10"	4"	1½"	⅝"
L6	3"	No. 14 Enameled	8	10"	4"	1½"	⅝"
L7	5"	No. 14 Enameled	8	5½"	T-7053	T-7052	T-7051
Link		See Text					

THORDARSON

50-Watt Transmitter « « Push-Pull 210's

This is a simple, inexpensive transmitter for use where space is limited. It is easily adjusted and can be used as shown or with crystal control. When crystal control is used, L1 is replaced with a center tapped grid choke and the crystal is connected between the two grids. This is especially recommended if the transmitter is to be used for phone work. The r.f. unit can also be used as an exciter for a high power amplifier if desired.

The filament transformer T-6417 has three separate secondary windings—7.5 volts at 6.5 amps., 7.5 volts at 4.5 amps., and 2.5 volts at 4 amps.—which supply the filaments of the 45 oscillators, 210 amplifiers, and 210 modulators. T-6280 furnishes 525 volts D.C. at 150 ma. through the T-6405 and T-6409 Chokes.

Type 210 tubes may be used very successfully in Class B circuits, as is demonstrated by their wide popularity. The speech amplifier and modulator circuit shown employs a pair of type 45's to drive the 10's and affords a total audio output of 30 watts.

In the power supply for the modulators, a T-5140 Special Voltage Regulating Transformer, designed for these tubes in Class B circuits, is used. It supplies 510 volts D.C. at 30 to 200 ma. through the filter.

Both modulators and the Class C amplifier may be operated from a single power supply using T-7041 Plate Transformer and chokes T-6315 and T-6409. The B plus for the modulators would then be taken off at the junction between the two chokes. Although satisfactory operation can be obtained with this method, it will not possess the unusual regulation provided by the T-5140 Transformer, but it has the advantage of making the total cost considerably less.

Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding 1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	1"	No. 30 D.C.C.	55	3"	1-1/16"	1/2"	1/5"
L2	3"	No. 14 Enameled	12	5 1/2"	2"	3/4"	3/8"
L3	3"	No. 14 Enameled	12	5 1/2"	2"	3/4"	3/8"

THORDARSON Equipment for 50-Watt Transmitter

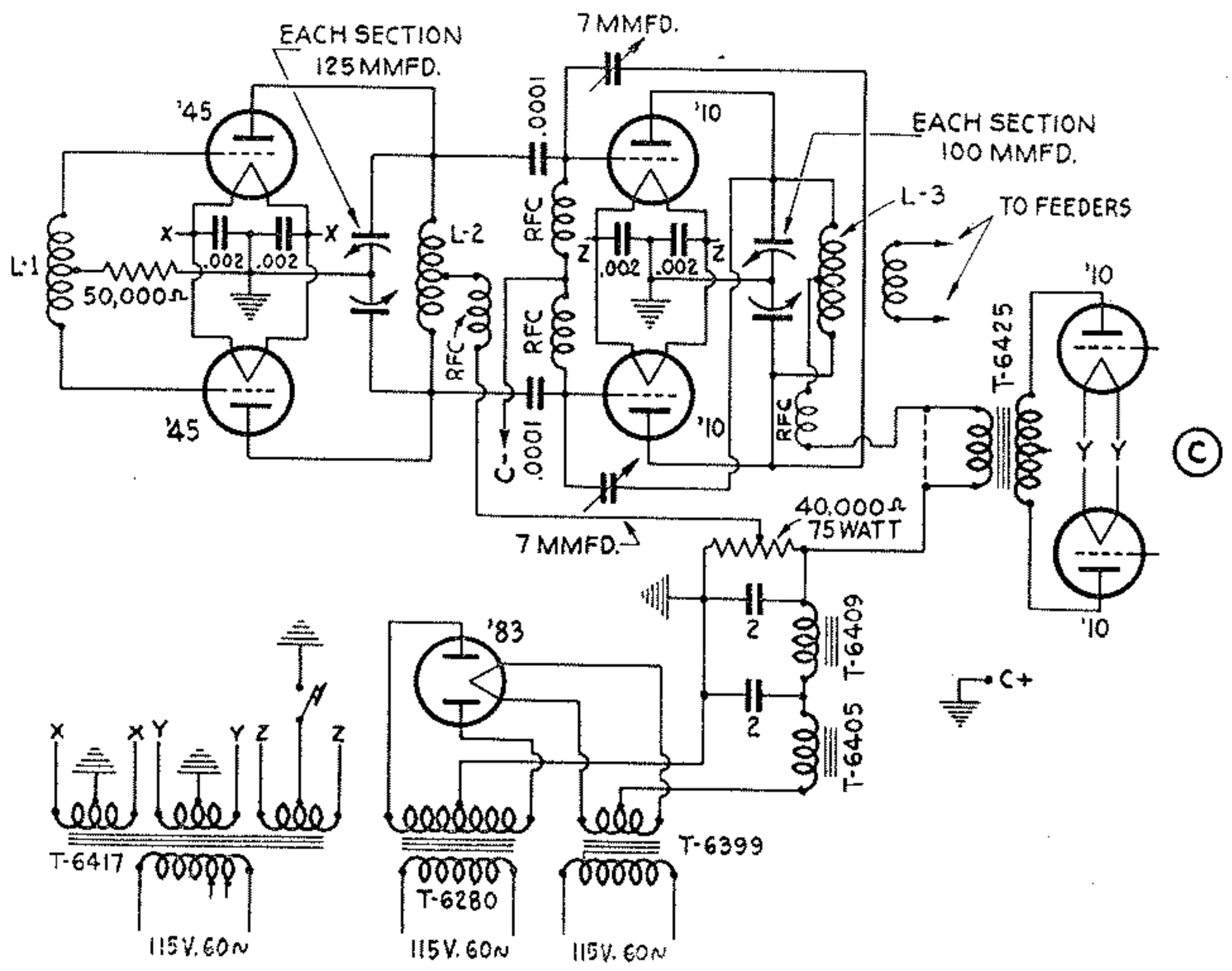
Radio Frequency Stages

T-6417 Multiple Secondary Filament Transformer
T-6280 Plate Transformer
T-6399 Filament Transformer
T-6405 Input Choke
T-6409 Filter Choke

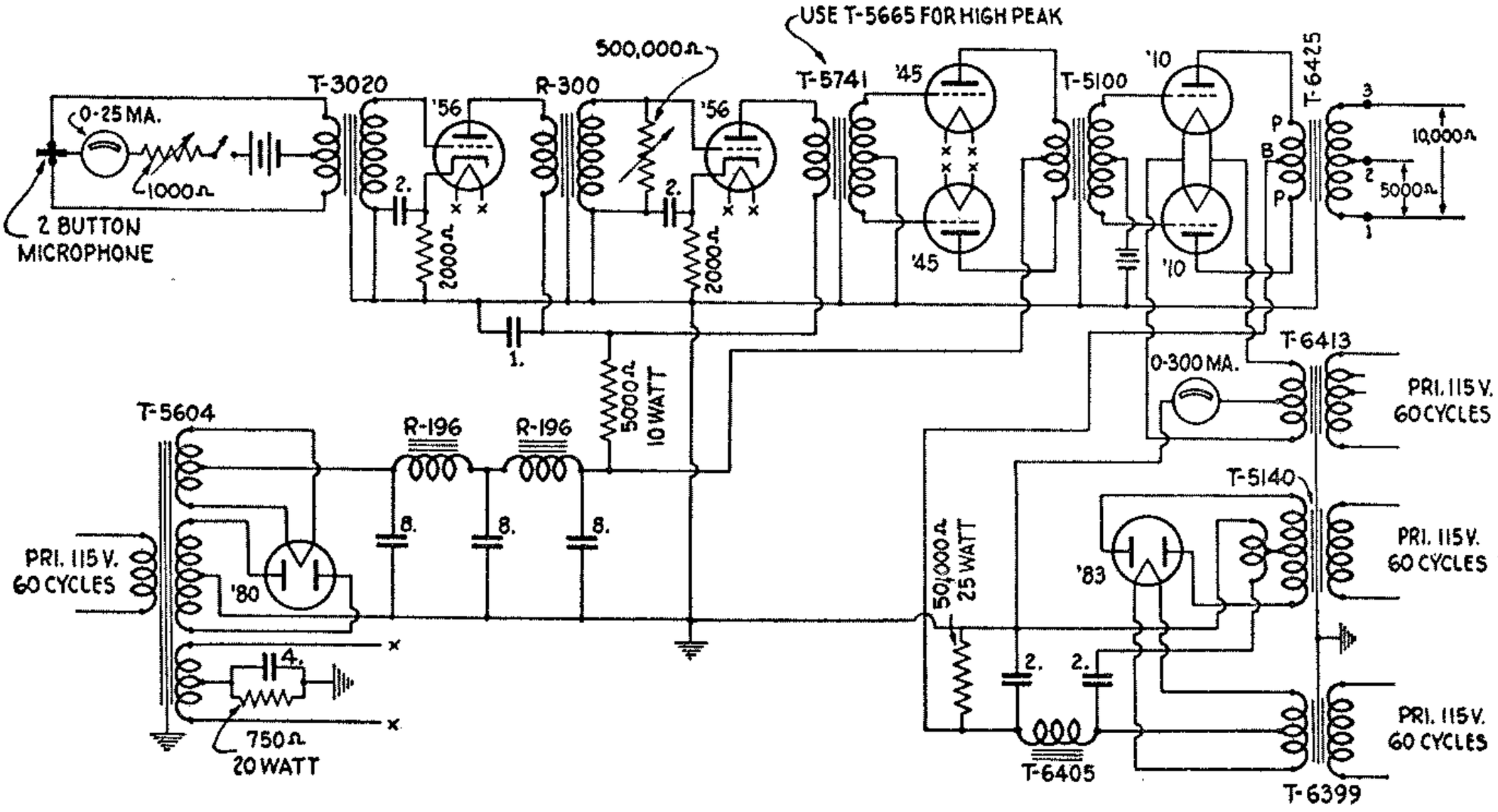
Modulator and Speech Amplifier

T-5604 Combination Plate and Filament Transformer
R-196 Filter Choke (two)
T-6413 Filament Transformer
T-5140 Regulating Plate Supply Transformer
T-6399 Filament Transformer
T-6405 Filter Choke
T-3020 Microphone Transformer
R-300 Interstage Transformer
T-5741 Push-Pull Input Transformer
T-5100 Class B Input Transformer
T-6425 Class B Output Transformer

Radio Frequency Stages



Modulator and Speech Amplifier "C"



Class B Modulation « «

Practical tests during the past few years have established the superiority of Class B modulation beyond any doubt. The newest high power broadcast transmitters are employing high level Class B modulation. For amateur phone work it possesses exceptional advantages. The high efficiency of the tubes in this type of amplification makes possible high percentage plate modulation at reasonable cost—and, of course, plate modulation permits higher peak output than either grid or screen modulation.

To secure highest output with minimum distortion in a Class B stage, the driver must be capable of supplying constant and ample power to the grids of the output tubes on signal peaks when the maximum grid current is drawn. The driver transformer must efficiently transfer this power from the driver to the modulators at all required frequencies. To accomplish this, and at the same time keep leakage reactance and D.C. resistance at an optimum point, requires careful design and construction, using ample copper and core materials.

The output transformer must be large enough to handle the audio power. In addition, the D.C. of the modulated amplifier passing through the secondary must not cause core saturation, with its consequent loss in efficiency. This is especially important at the lower audio frequencies.

In a Class B circuit, there is distortion in both the plate and the grid circuits, due to the non-linearity of the grid and plate current curves of the tubes. Since these two circuits are approximately 180 degrees out of phase, by properly designing the input and output transformers it is possible to practically cancel both types of distortion. Obviously, best results can only be obtained if the input and output transformers are designed to work together.

The Class C amplifier presents a constant load at all frequencies on the output transformer, and the impedance of that load is equal to the plate voltage of the modulated tube or tubes divided by the total plate current. The recommended load for the output transformer should be followed as closely as possible, and the Load Impedance Chart on page 30 will be of assistance in determining the proper operating conditions.

The bias on the Class B stage should be checked at regular intervals, since the grid current may tend to change a battery bias, particularly if the batteries are old, and to increase the bias beyond the best operating point. If a rectifier bias supply is employed, it should be of low resistance and have excellent regulation.

Great care should be taken to filter all r.f. out of the audio system, since the slightest trace will apply an r.f. voltage to the carrier that is out of phase and may cause a "fuzzy" signal.

The regulation of the power supply for Class B modulators is also important, since poor regulation limits the power output and may also cause distortion by failing to supply sufficient power on signal peaks. The reader will find a discussion of regulation on page 25, under Transmitter Plate Transformers.

40-Watt Transmitter « « Push-Pull 46's

As receiving tubes are used throughout in both the radio frequency section and the modulator, this transmitter is very economical in its original cost and in its upkeep. Furthermore, as the plate voltage used is only slightly higher than that in receivers, it is ideal for the amateur who dislikes to work with high voltages. It can fill in nicely during silent hours when high power equipment cannot be operated.

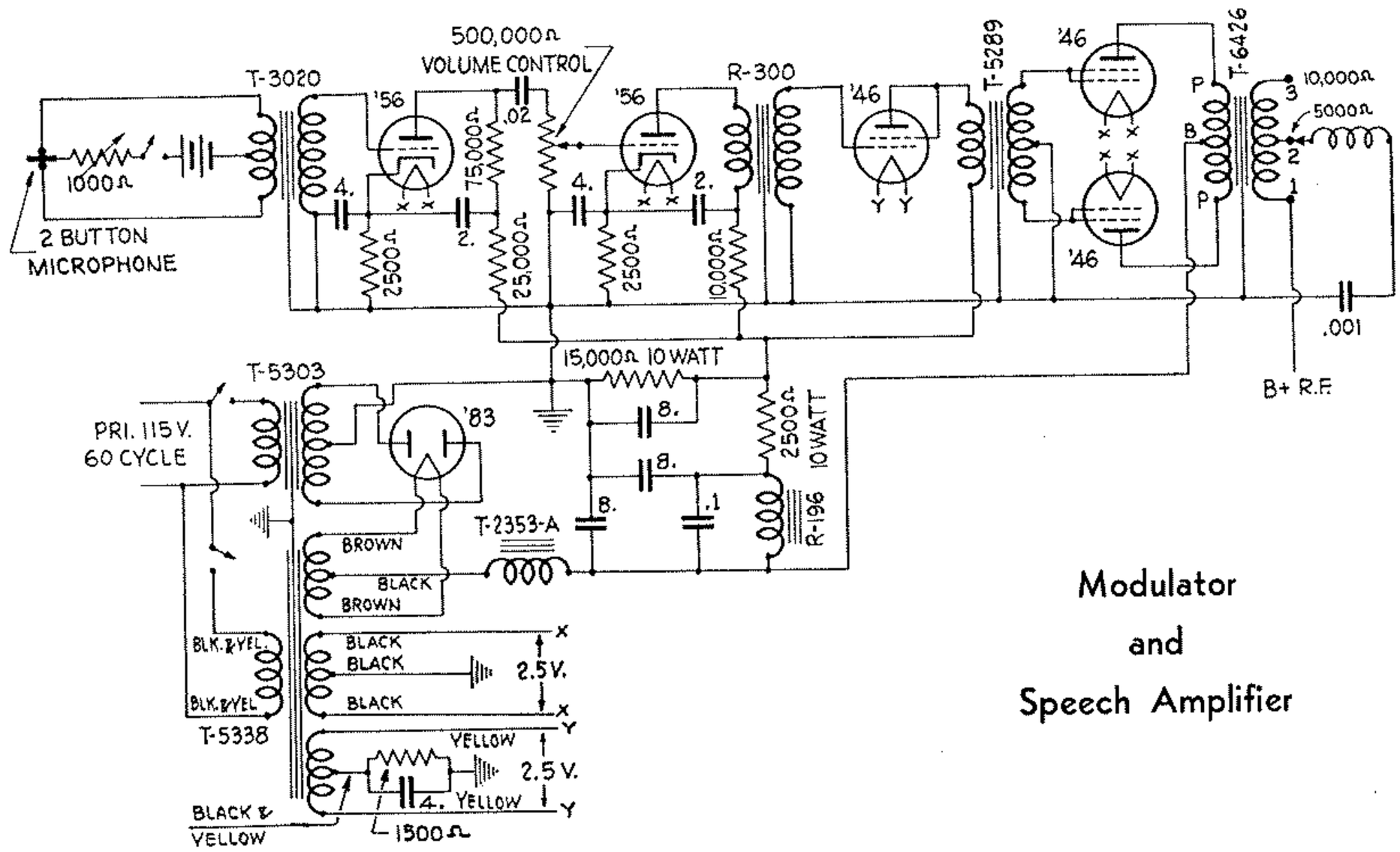
T-6094 is a multiple secondary transformer supplying all the filaments in the radio frequency section, as well as the filament of the 83 rectifier. Plate supply for the radio frequency section is furnished by transformers T-6280 and T-6405, and T-6409 Chokes. The full plate voltage of 525 volts D.C. is applied to the plates of the 46 buffer amplifier and the push-pull 46's, but it is reduced to 350 volts for the plate, and 100 volts for the screen grid of the 47 oscillator.

Transformer T-5338 supplies filament voltage for all the tubes in the speech amplifier and modulator unit, and in addition furnishes 3 amperes at 5 volts for the 83 rectifier. Plate voltage for the speech amplifier and modulator is supplied by transformer T-5303. T-2353A acts as a swinging choke and R-196 is used for additional filtering of the speech amplifier supply.

Although a crystal oscillator is shown and recommended, it is not absolutely essential. Any of the oscillator circuits shown in the first part of the book may be used, but careful adjustment is necessary. Frequency stability is of prime importance and every effort should be made to attain it. A good frequency meter is an absolute necessity

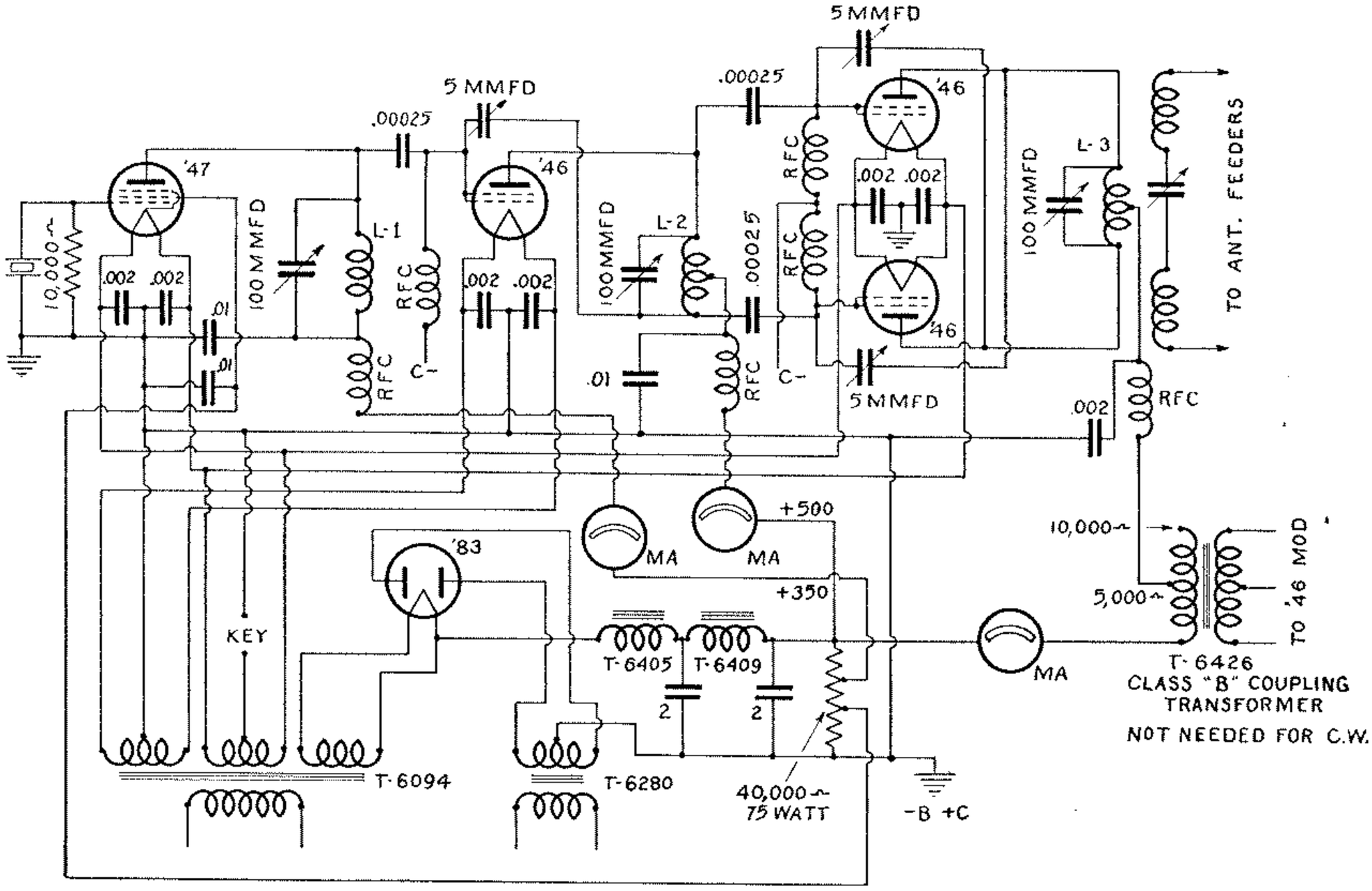
THORDARSON Equipment for 40-Watt Transmitter

T-6094	Multiple Secondary Filament Transformer
T-6280	Plate Transformer
T-6405	Input Choke
T-6409	Filter Choke
T-6426	Class B Coupling Transformer
T-5303	Plate Transformer
T-5338	Multiple Filament Transformer
T-2353-A	Input Choke
R-196	Filter Choke
T-3020	Microphone Transformer
R-300	Interstage Transformer
T-5289	Class B Input Transformer



Modulator and Speech Amplifier

Radio Frequency Stages and Power Supply



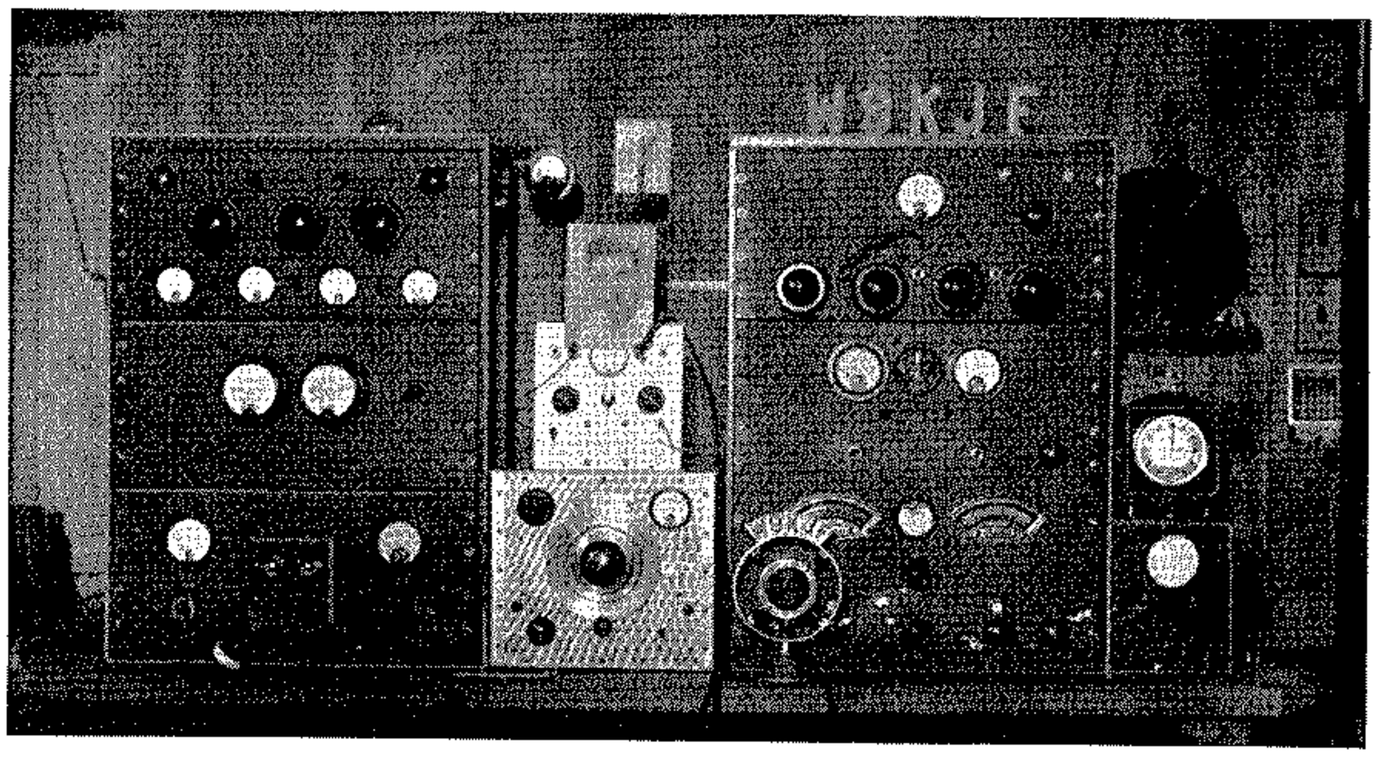
with any transmitter, and is of vital importance when a self-excited oscillator is used.

The 46 tube following the oscillator can be used as a straight amplifier as shown, or may be used as a frequency doubler. In the latter case the bias should be about 90 volts. With this arrangement crystal control can be used on all bands. Using a 160-meter crystal, each stage is tuned to the operating frequency for 160 meter operation. The 46 can then be used as a doubler for 80-meter operation, or an 80-meter crystal can be used. With the oscillator working on 80 meters, the 46 may be used to double to 40 meters, or a 40-meter crystal can be used to permit operation on the 40 and 20-meter bands.

If the L2 coils are properly adjusted so the tuning condenser has approximately the same setting for all bands, the neutralizing condenser can be adjusted and need not be changed for any band. The same thing applies to the L3 coils in the final amplifier. Coil specifications are given, but the exact number of turns and spacing will vary slightly, depending upon the length of leads and type of tuning condensers used.

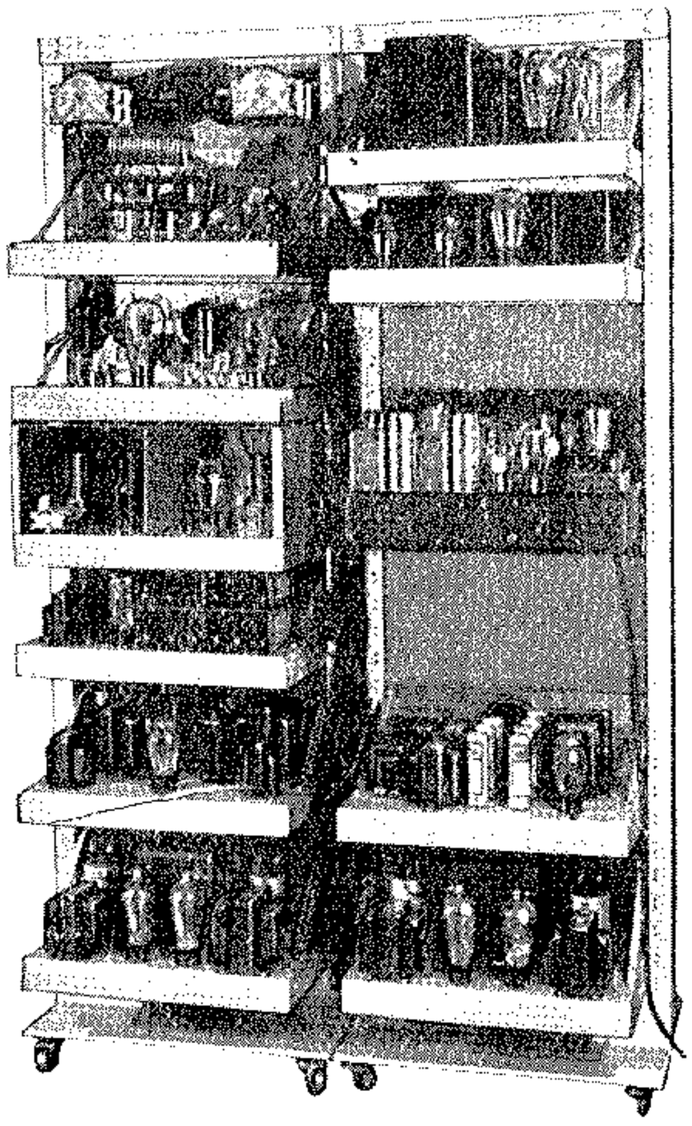
Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding			
				1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	3"	No. 16 Enameled	8	7"	2¾"	1"	½"
L2	3"	No. 16 Enameled	8	7"	2¾"	1"	½"
L3	3"	No. 12 Enameled	8	7"	2¾"	1"	½"



Amateur Station W9KJF, owned and operated by Eugene Van Sickle, Indianapolis, Ind.—equipped with THORDARSON Transformers.

120-Watt « « 801 Transmitter



Rear View of W9USA-R.F. Section at Left—Modulator Section at Right.

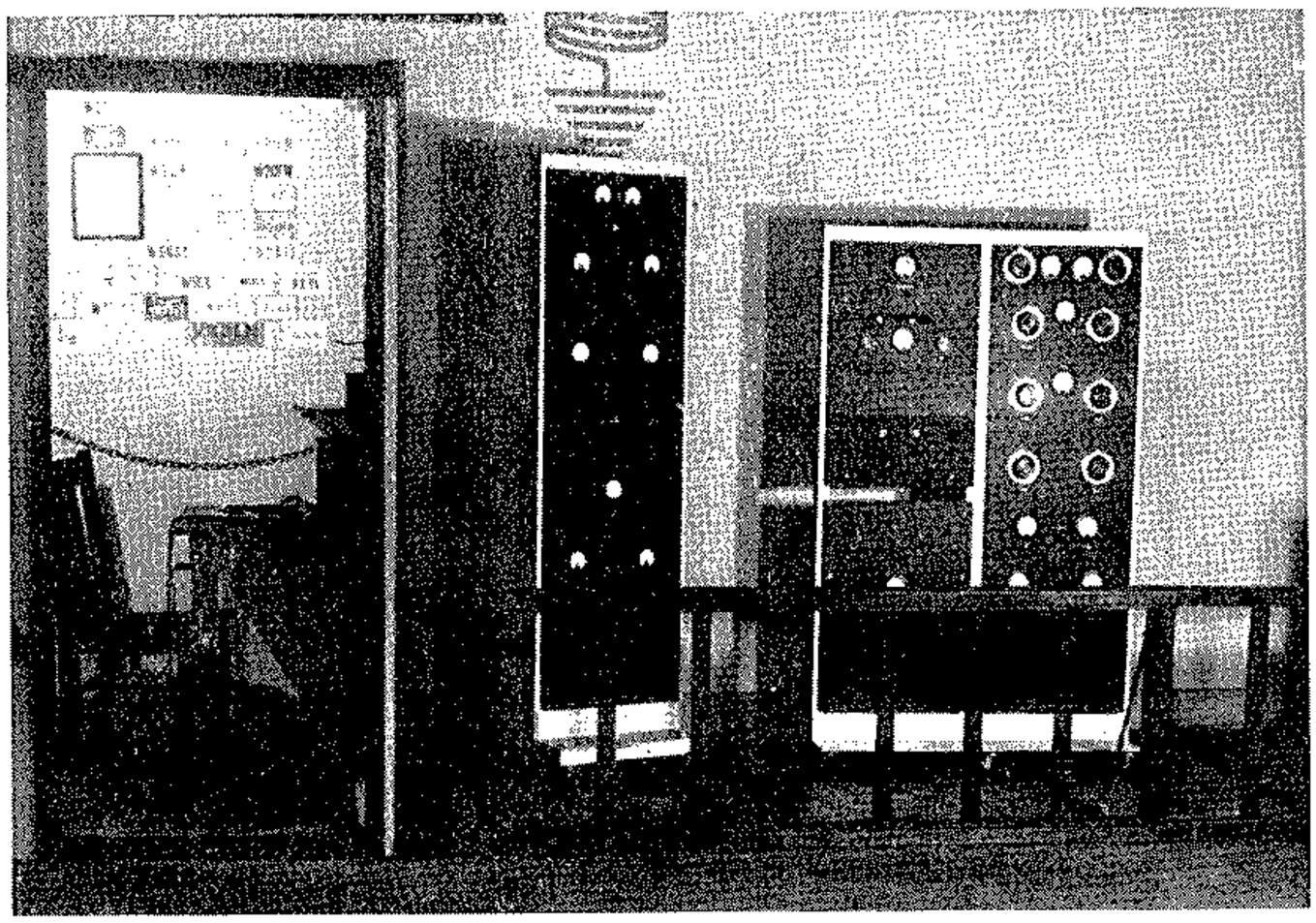
This 120-watt transmitter uses the new type 801 tubes as Class B modulators. Operating with a plate voltage of 750, they supply 60 watts of audio power, which is enough to give 100% modulation of the 120 watts input to the 203A tube.

The new type 801 tube appears to have many advantages over the old type 210. Laboratory tests have proven its superiority as a Class B modulator, peak-outputs of close to 100 watts being possible. The T-7084 Class B Coupling Transformer has been carefully designed and constructed for the 801 tubes, so that the maximum audio power may be realized. The secondary has taps for 12,500, 6250 or 4510-ohm loads, making it possible to use various Class C amplifier voltages and currents, and will carry up to 200 ma. D.C. The extra large core and design make this possible without saturation, the dimension being 6½" x 5¾" x 8", and the weight 18 lbs.

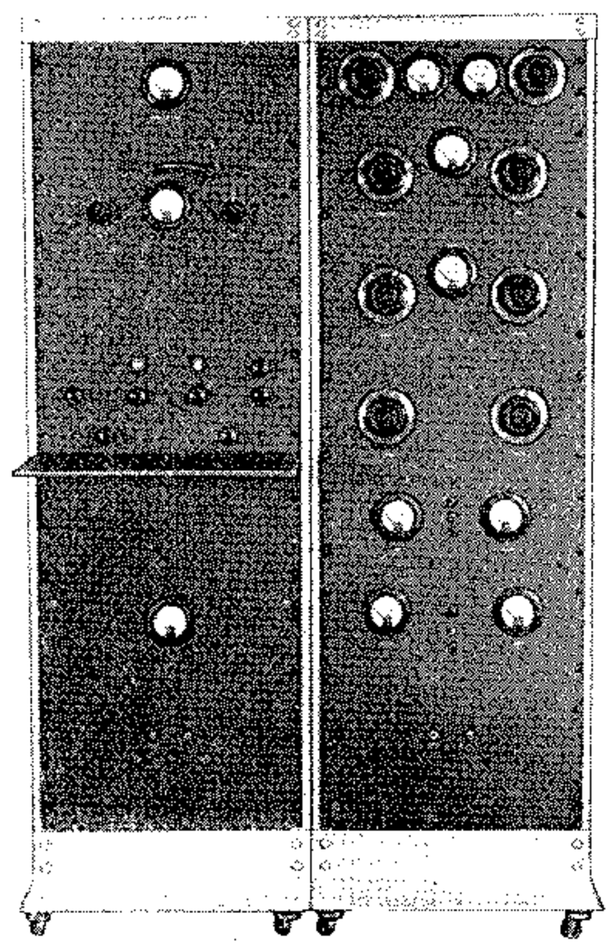
One power supply system, using the T-6412 Plate Transformer, is provided for the modulators and the 203A radio frequency amplifier. This arrangement is made possible by the excellent regulation of the T-6412 Transformer and the proper design of the T-6406 and T-6407 Input and Smoothing Chokes.

All plate, filament, and grid voltages for the speech amplifier are supplied by the low-cost power supply transformer, T-4900. Two multiple-secondary filament transformers are used; T-6417 to supply the '47 oscillator, 801 buffer amplifier, and the two 801 modulators; and T-6421 to supply the two 866 and the one 83 rectifiers. Plate voltage for the oscillator and the buffer amplifier is supplied by Transformer T-6280.

Although a single 203A is shown as the Class C amplifier, other types of tubes can be used with equally good results. A single type 800 tube or an RK18 would be quite satisfactory, as would one or two of the newer type tubes which are rated at 750 volts. The only changes necessary will be in the filament transformer and possibly the size of the neutralizing condenser. The type of oscillator is also a matter of choice, the 59 tritet will be just as satisfactory as the circuit shown.

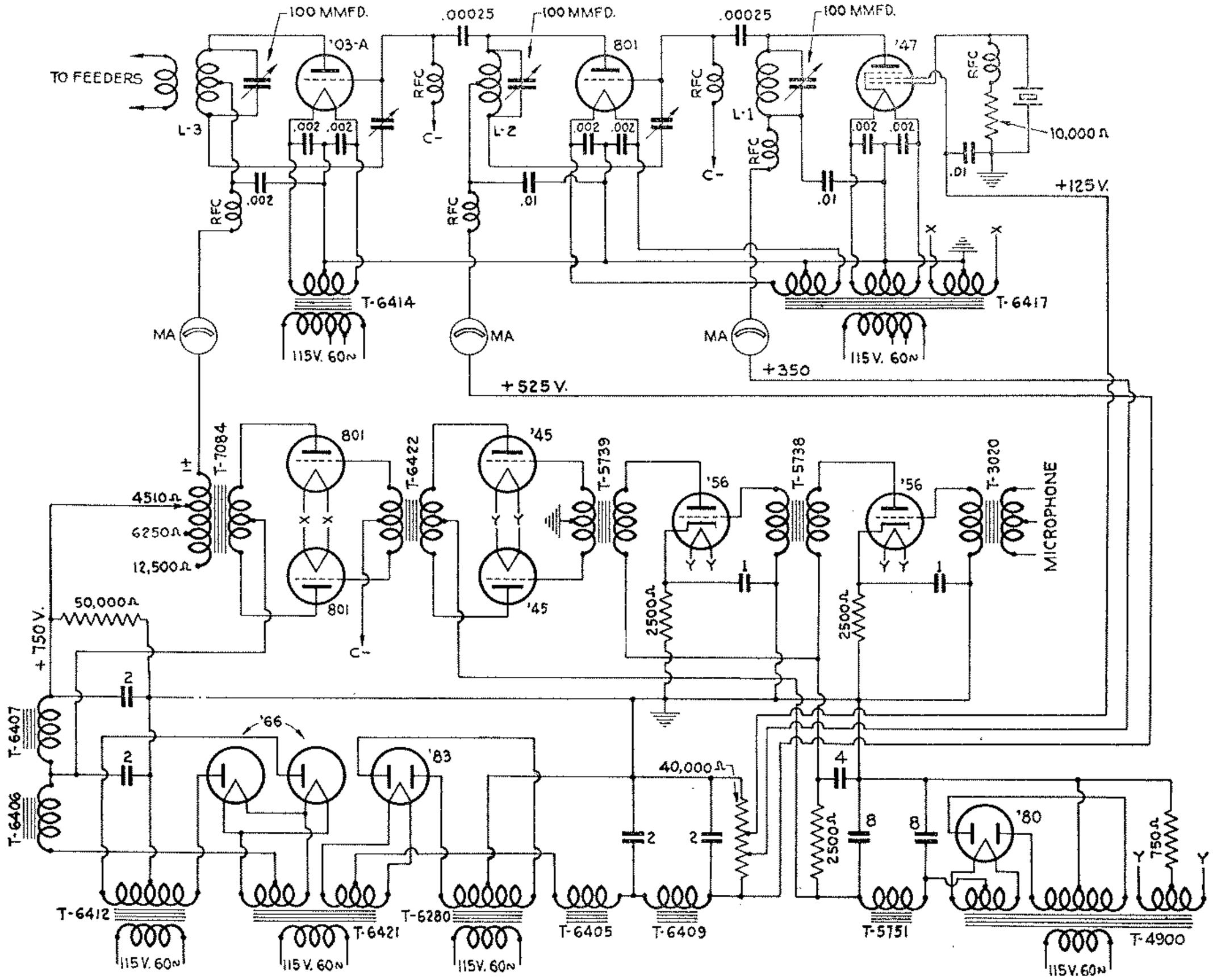


Station W9USA of the World's Fair Radio Amateur Council. Final Amplifier Push-Pull 800's, Modulated by Class B 800's. Completely equipped with THORDARSON Transformers.



Front view of W9USA-R.F. and Modulator Sections

Complete 120-Watt 801 Transmitter



THORDARSON Equipment for 120-Watt 801 Transmitter

T-6412	Plate Transformer
T-6421	Multiple Filament Transformer
T-6280	Plate Transformer
T-6405	Input Choke
T-6409	Filter Choke
T-4900	Combination Plate and Filament Transformer

Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding			
				1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	3"	No. 16 Enameled	8	7"	2¾"	1"	½"
L2	3"	No. 14 Enameled	8	7¼"	3"	1"	½"
L3	4"	No. 14 Enameled	8	7¼"	T-7053	T-7052	T-7051

T-5751	Filter Choke	T-3020	Microphone Transformer
T-6406	Input Choke	T-5738	Interstage Transformer
T-6407	Filter Choke	T-6422	Class B Input Transformer
T-6417	Multiple Filament Transformer	T-7084	Modulation Transformer
T-6414	Filament Transformer	T-5739	Push-Pull Input Transformer

500-Watt Transmitter « « Push-Pull 852's

This transmitter may be used on 20-40-80 or 160-meter bands for C.W. or 20-80-160-meter bands for phone. The three stages between oscillator and final amplifier give excellent stability and sufficient excitation for phone operation.

Although rated at 500 watts, the two 852's in the final amplifier can be run at greater inputs if properly adjusted and used with an efficient antenna system.

T-6416, a multiple secondary filament transformer, supplies the filaments of all tubes in the radio frequency section of the transmitter. T-6421 supplies the filaments of the 83 and 866 rectifiers. Two plate transformers supply plate voltage for all radio frequency stages.

The audio system is designed for excellent quality, with a variation of only a fraction of a decibel from 60 to 7000 cycles.

A high gain speech amplifier of this type requires careful construction, and all parts must be of good quality. Power and filament transformers should be mounted as far away from the input circuit as space will permit, to prevent 60-cycle pickup, as the amplifier has excellent response at this frequency.

Exceedingly good regulation of the modulator power supply voltage is necessary for efficient Class B operation. Good quality and maximum audio power cannot be obtained without it. Power transformers and chokes must be properly designed and constructed and able to supply the high peak plate current required, with a minimum voltage variation. The power supply shown will deliver the rated voltage and current to the tubes, resulting in highest efficiency.

The primary supply leads must be large enough to carry the current required without appreciable voltage drop.

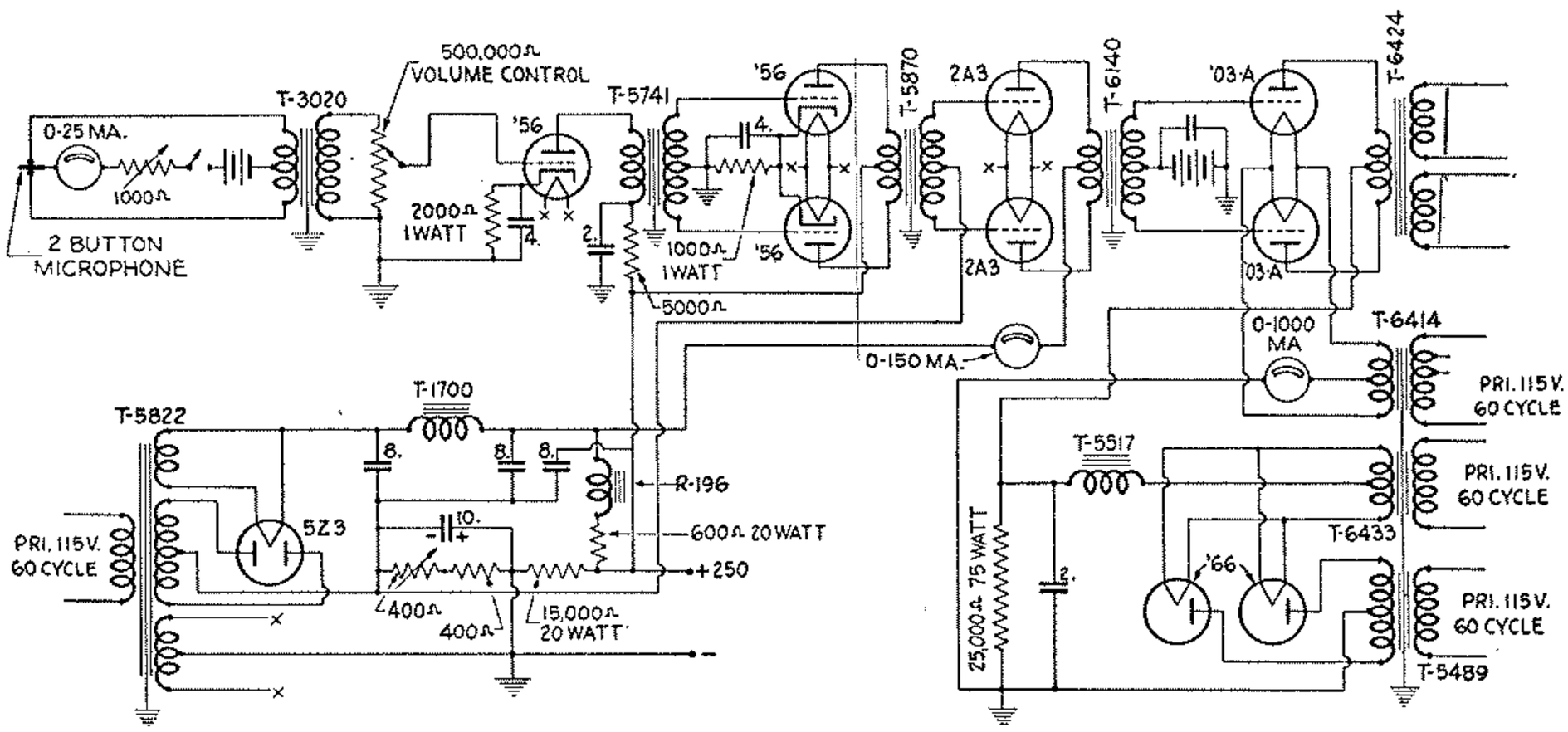
No matter how good the transformer design, good regulation cannot be obtained without proper primary voltage. Use heavy wire for all supply leads right up to the transformers.

Filament leads to all tubes requiring considerable current should be large enough to prevent any voltage drop.

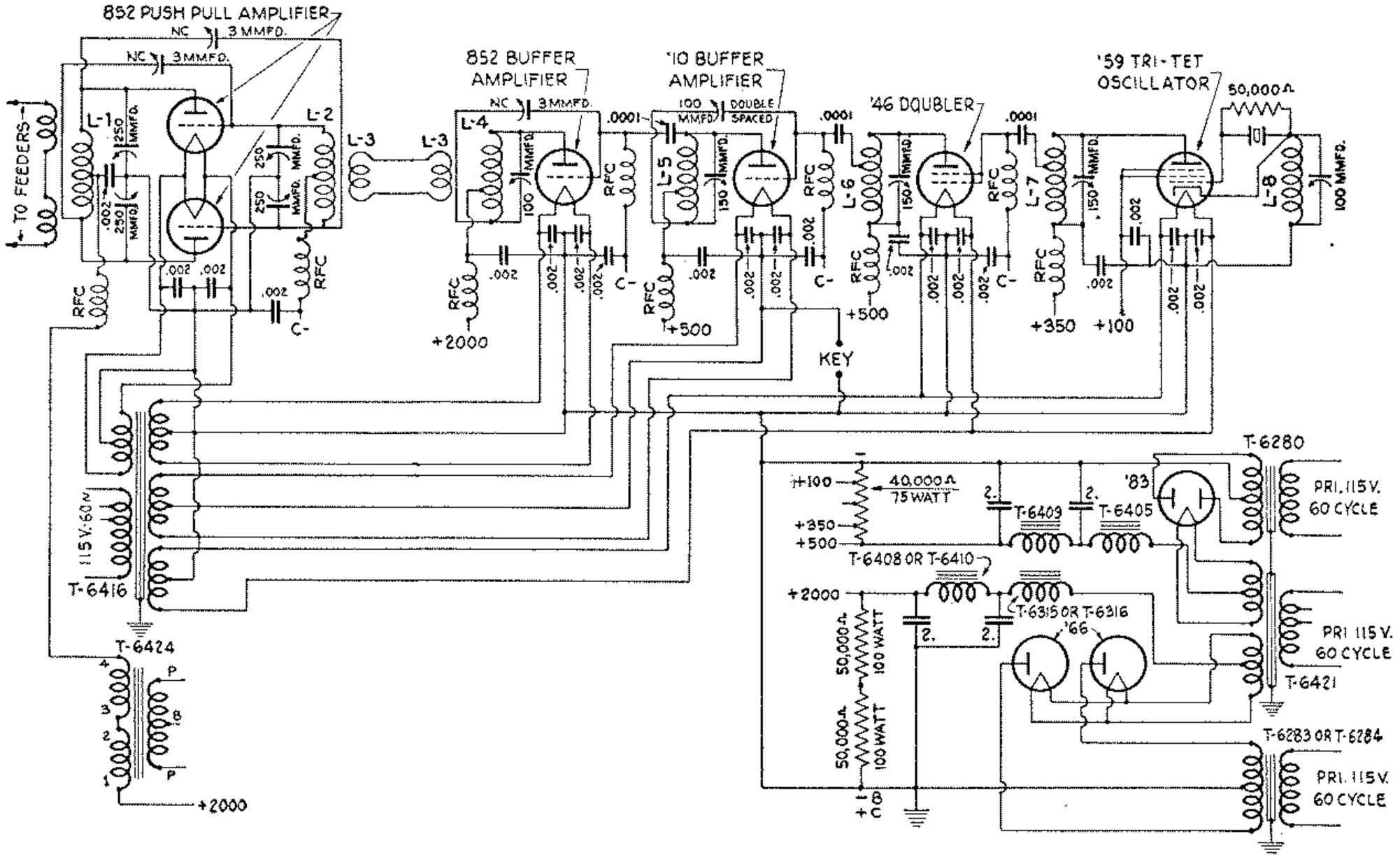
Radio Frequency Coil Data

	Dia.	Wire Size	1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	4"	THORDARSON Induc-		T-7053	T-7052	T-7051
L2	2"	No. 14 D.C.C. [tance		22	8	4
L3	1½"	No. 18 D.C.C. Inserted Within L2 and L4		6	4	4
L4	4"	THORDARSON Induc-		T-7053	T-7052	T-7051
L5	2"	No. 14 D.C.C. [tance		22	8	4
L6	2"	No. 14 D.C.C.		22	8	4
L7	1¼"	No. 18 D.C.C.		35	15	
L8	1¼"	No. 22 S.S.C.	90	35		

Modulator and Speech Amplifier



Radio Frequency Stages and Power Supply



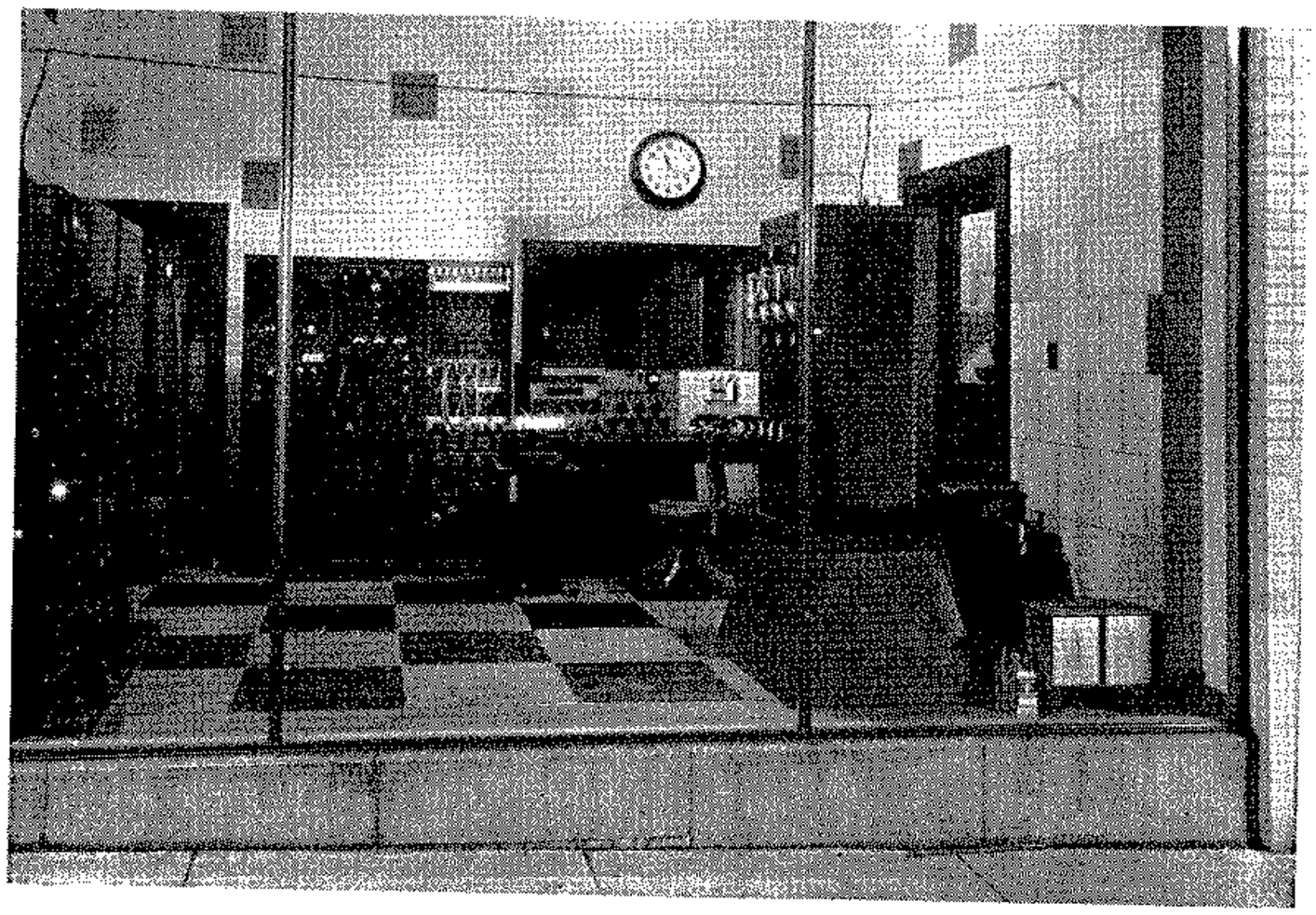
THORDARSON Equipment for 500-Watt Transmitter

Modulator and Speech Amplifier

T-5822	Combination Plate and Filament Transformer
T-1700	Filter Choke
R-196	Filter Choke
T-5489	Plate Transformer
T-6433	Filament Transformer
T-6414	Filament Transformer
T-5517	Input Choke
T-3020	Microphone Transformer
T-5741	Push-Pull Input Transformer
T-5870	Push-Pull Interstage Transformer
T-6140	Class B Input Transformer
T-6424	Modulation Transformer

Radio Frequency Stages

T-6416	Multiple Secondary Filament Transformer
T-6280	Plate Transformer
T-6421	Multiple Filament Transformer
T-6283 or T-6284	Plate Transformers
T-6405	Input Choke
T-6409	Filter Choke
T-6315 or T-6316	Input Chokes
T-6408 or T-6410	Filter Chokes



Control and Transmitter Room of WIBM, Jackson, Michigan. WIBM is equipped with THORDARSON Transformers.

20-Watt Portable « « 6A6 Transmitter

This portable transmitter, which is designed for operation at 80, 40, 20, or 10 meters—has an input of 20 watts for 100% modulated phone transmission. For C.W. it can be run at a greater power input.

The outstanding feature of this transmitter is its remarkably small size—the complete outfit, including power supply, can be mounted in a case 9¼" x 16¼" x 6" inside dimensions. In the radio frequency circuit a 6A6 tube is used as a push-pull oscillator, and another 6A6 as a push-pull amplifier. The method of coupling used provides ample excitation to the amplifier stage—in the experimental model inputs up to 50 watts were obtained for C.W. operation.

The oscillator circuit is the same as the tuned-plate – tuned-grid system described previously. In this circuit the coupling coils are tightly coupled to the oscillator plate coil, and the plate tuning condenser tunes both the oscillator plate circuit and the amplifier grid circuit.

All the coils are wound on Hammarlund Isolantite 5-prong coil forms, and Hammarlund Isolantite sockets are used for both coils and tubes. Specifications are not given for antenna coils, as they will depend upon the type of antenna used. For two-wire feeders, three turns at each end of L3 will be found satisfactory. The coupling should be adjusted for the proper amplifier plate current.

Complete coil data is given for four wave bands, but due to the difference in individual layout and wiring, some slight adjustments may be necessary for maximum efficiency.

After the amplifier is once properly neutralized, no further adjustment of the neutralizing condensers is necessary. Where A.C. is not available, a 6-volt storage battery and a motor-generator or B-batteries may be used. With such an arrangement the whole outfit can be used as a stand-by transmitter for use in emergencies when the A.C. power fails, or can be easily stored away on an auto trip and set up whenever desired.

The speech amplifier employs a type 89 tube in order to attain sufficient power sensitivity to drive the 6A6 modulator to full output from a microphone source. The final stage, when used for phone transmission, should be adjusted to 83 ma. at 250 volts to properly match the modulation transformer.

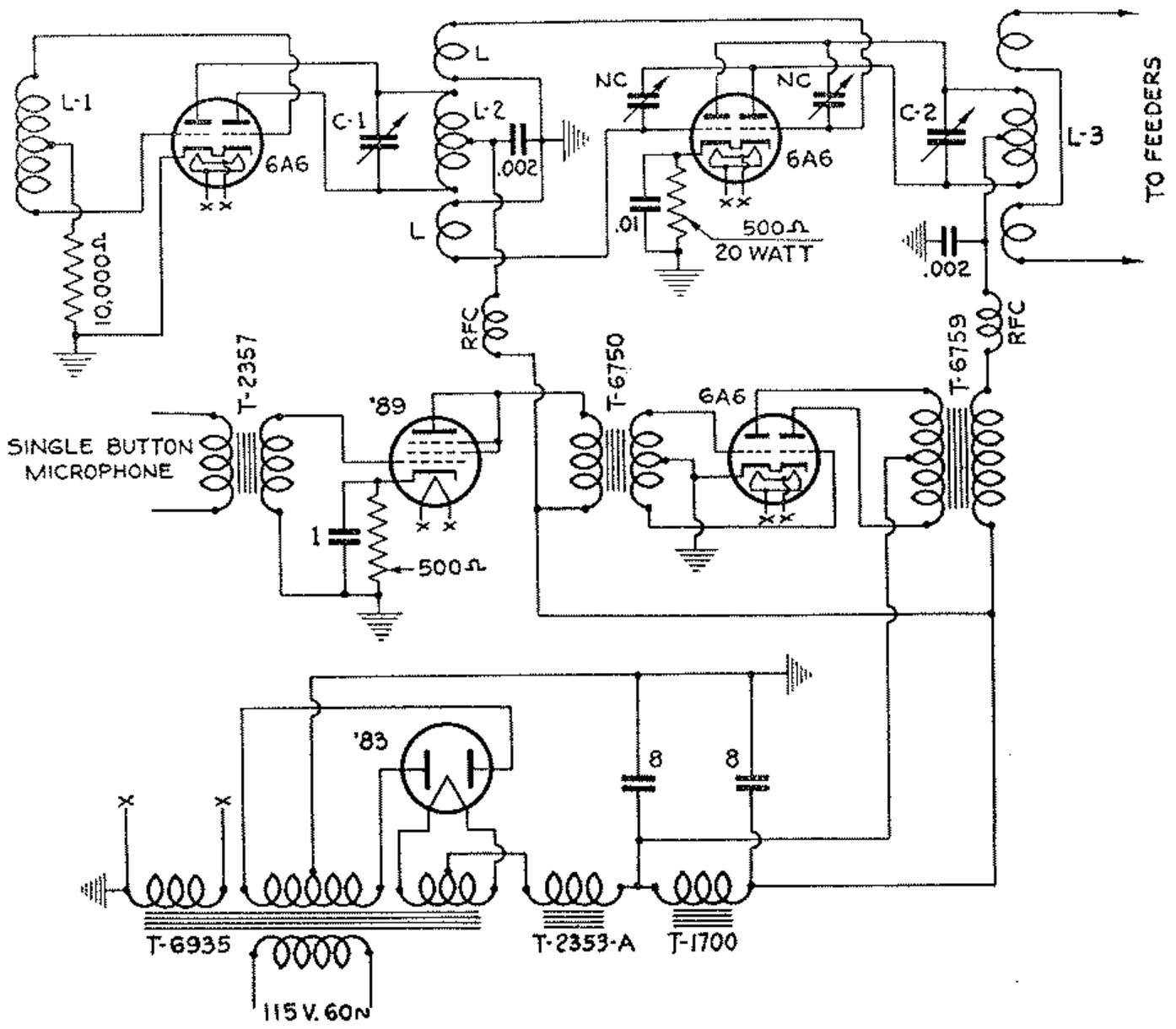
Radio Frequency Coil Data

All coils wound on Hammarlund Isolantite forms 1½" O.D., except for 80-meter operation

	Coil	3500 KC.	7000 KC.	14,000 KC.	28,000 KC.
L1	C.T. ½ of winding close	80 turns No. 24E	40 turns No. 24E	16 turns No. 24E	6 turns No. 24E
L2	wound at each	24 turns No. 24E	14 turns No. 24E	4 turns No. 24E	2 turns No. 24E
L	end of L2.	10 turns No. 24E	10 turns No. 24E	2 turns No. 24E	2 turns No. 24E
L3	(See Text)	26 turns No. 18E*	14 turns No. 18E	6 turns No. 18E	4 turns No. 18E

**Note: Wound on 2¼" O.D. Bakelite Tubing, Mounted on a 5-Prong Tube Base*

C1—Hammarlund MC50-S.
C2—Hammarlund MC50-MX.
NC —Hammarlund MC20-SX.
RFC—Hammarlund Midget RF Chokes.



THORDARSON Equipment for 20-Watt Portable Transmitter

T-6935	Multiple Secondary Plate and Filament Transformer
T-2353-A	Input Choke
T-1700	Filter Choke
T-2357	Microphone Transformer
T-6750	Input Transformer
T-6759	Modulation Transformer

Grid Modulated « « Transmitter

Push-Pull 210's or 801's

The outstanding feature of this transmitter employing grid-bias modulation is its low cost. Few tubes are required—the speech amplifier and modulator uses only two audio stages. In addition, the power supply consists of only two units.

A combination plate and filament transformer, T-5822, supplies the voltages for the speech amplifier, modulator, oscillator, and buffer amplifier—as well as the 5Z3 full-wave rectifier tube. Two T-5319 Filter Chokes and three 8-mfd. electrolytic condensers adequately filter the output. The full output of 365 volts is applied to the plates of the modulator, oscillator, and buffer amplifier while a tap is taken off the shunting resistance at 250 volts for the plate of the '56 speech amplifier tube, and at 100 volts for the screen grid of the oscillator tube.

The filament voltage for the 210's or 801's of the grid modulated amplifier is supplied by the transformer T-6435. The plate voltage of 750 volts D.C. is supplied by T-5448 through two 866 rectifier tubes. T-6433 furnishes 2.5 volts at 10 amperes for the filaments of these tubes. The filter for the 750-volt plate supply is composed of two T-5319 chokes and three 2-mfd. 1000-volt condensers.

The number of turns and the coupling of the link circuit between the buffer amplifier and the modulated amplifier should be adjusted for proper excitation and load.

Current in the plate circuit of the oscillator, the buffer amplifier, and the modulated amplifier is measured by a milliammeter in each circuit.

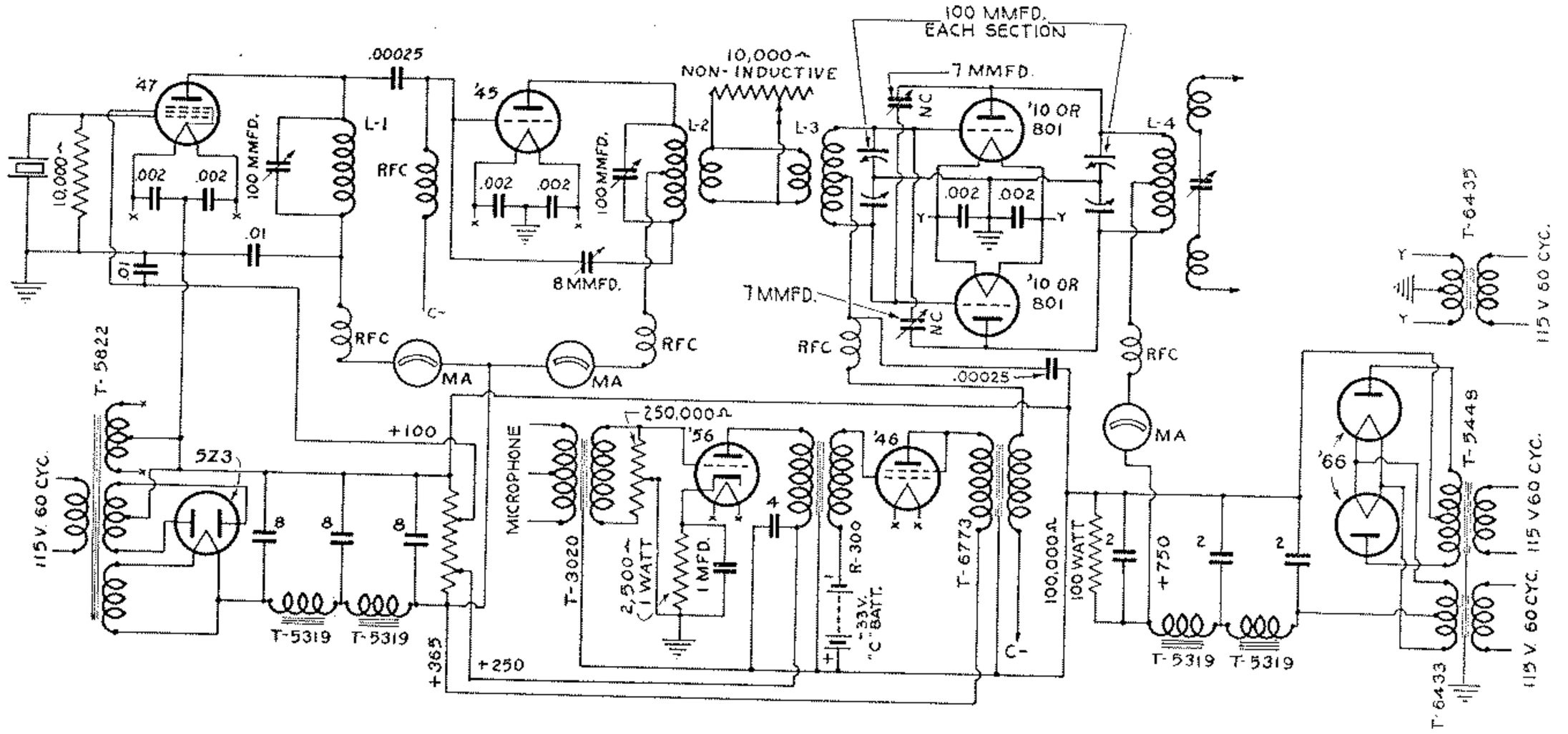
Grid bias for the 46 modulator tube is obtained by means of a 33-volt C battery.

THORDARSON Equipment for Grid Modulated Transmitter

T-6435	Filament Transformer
T-5448	Plate Transformer
T-6433	Filament Transformer
T-5319	Filter Choke (four)
T-6773	Grid Modulation Transformer
R-300	Interstage Transformer
T-3020	Microphone Transformer
T-5822	Plate and Filament Transformer

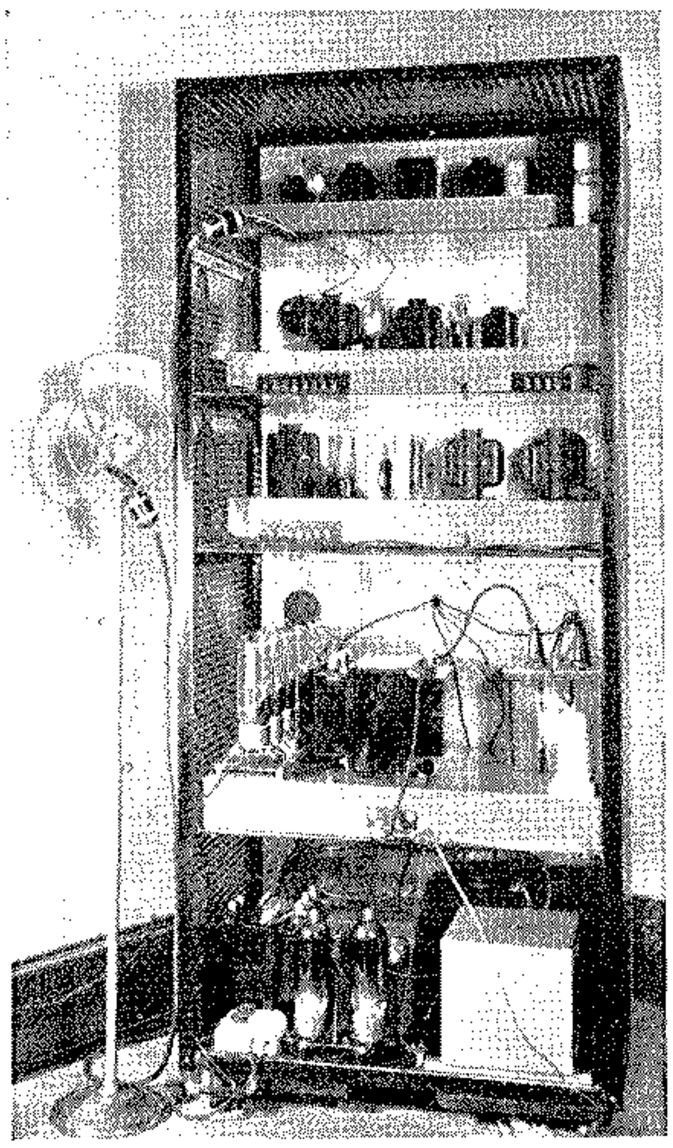
Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding	
				1700 KC.	3500 KC.
L1	3"	No. 16 Enameled	8	7"	2¾"
L2	3"	No. 16 Enameled	8	7"	2¾"
L3	3"	No. 14 Enameled	8	10"	4"
L4	5"	No. 14 Enameled	8	5½"	T-7053



18-Watt Speech Amplifier Type 2A5 Push-Pull Output

Class A-Prime

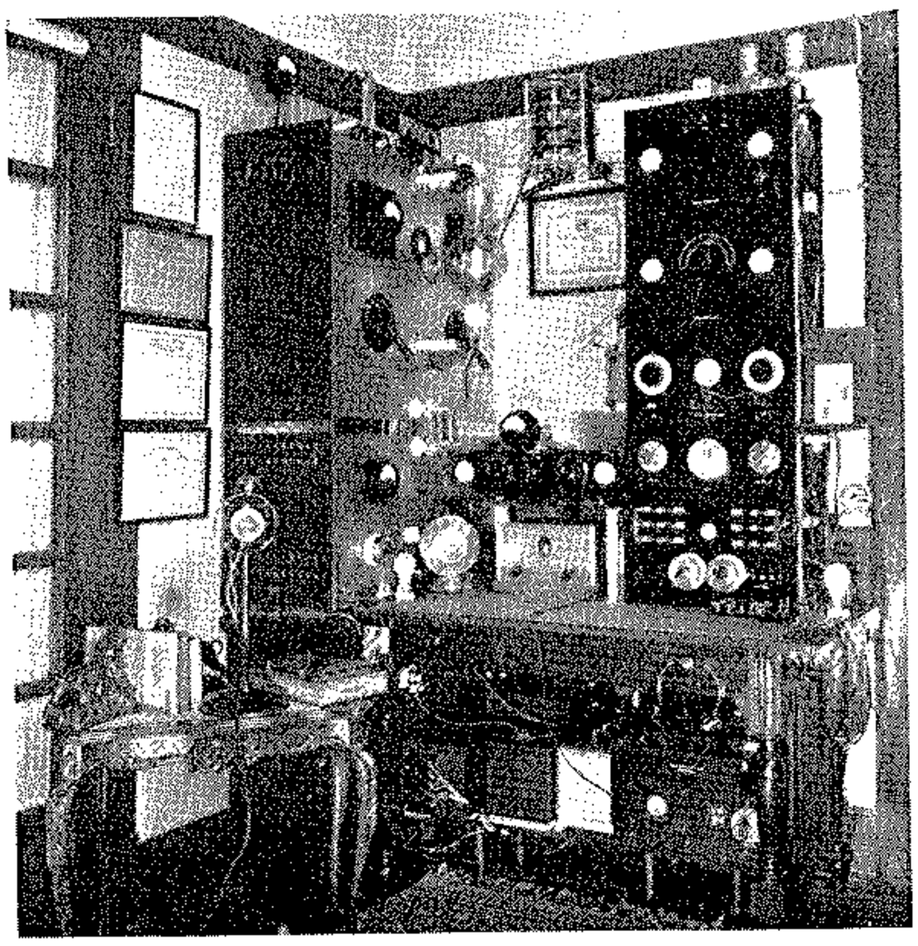


Rear of 2A5 Speech Amplifier and Push-Pull Parallel 03-A Modulator at W9DCX. Photo Courtesy Popular Mechanics.

Every operator of a phone transmitter has frequent use for a mixer circuit like that shown with this amplifier. It is possible with this mixer and amplifier to amplify the signal from four different sources, either separately or simultaneously. It is ideal for relaying signals either from a telephone line or a radio receiver, and at the same time, two microphones may be cut in. Thus the mixer may be used for actual comparison tests of different microphones. It is well adapted for automatic relaying, as described in July, 1934, Q.S.T.

The amplifier is capable of supplying an audio output of approximately 18 watts, using triode connected 2A5 tubes in a Class AB operation. An amplifier using 2A3 tubes in push-pull has been very popular because of the high power output and the excellent fidelity of reproduction. The only drawback to the 2A3 type of amplifier is due to the extreme delicacy of the filaments in this particular tube.

The output of a pair of 2A5 tubes as used in this amplifier is even higher than that possible with a pair of 2A3's. The power is sufficient to drive almost any type of modulator.



R.F. and Power Section of W9DCX, owned and operated by Frank Brittin, Chicago. Equipped with THORDARSON Transformers. Photo Courtesy Popular Mechanics.

Tests have shown that it can even be used to drive push-pull parallel 203-A's Class B to full output. The frequency response, as shown in the curve, is very good. In addition, these tubes —in place of a delicate filament—use a very sturdy cathode-heater type emitter which will withstand any reasonable amount of mechanical vibration. The entire amplifier has been designed to secure the utmost flexibility. It is divided into three sections, the first consisting of a four-position mixer circuit by means of which a microphone, a radio receiver, a low impedance line, as well as a high impedance pick-up, a crystal pick-up or a crystal microphone may be used, either separately or all simultaneously.

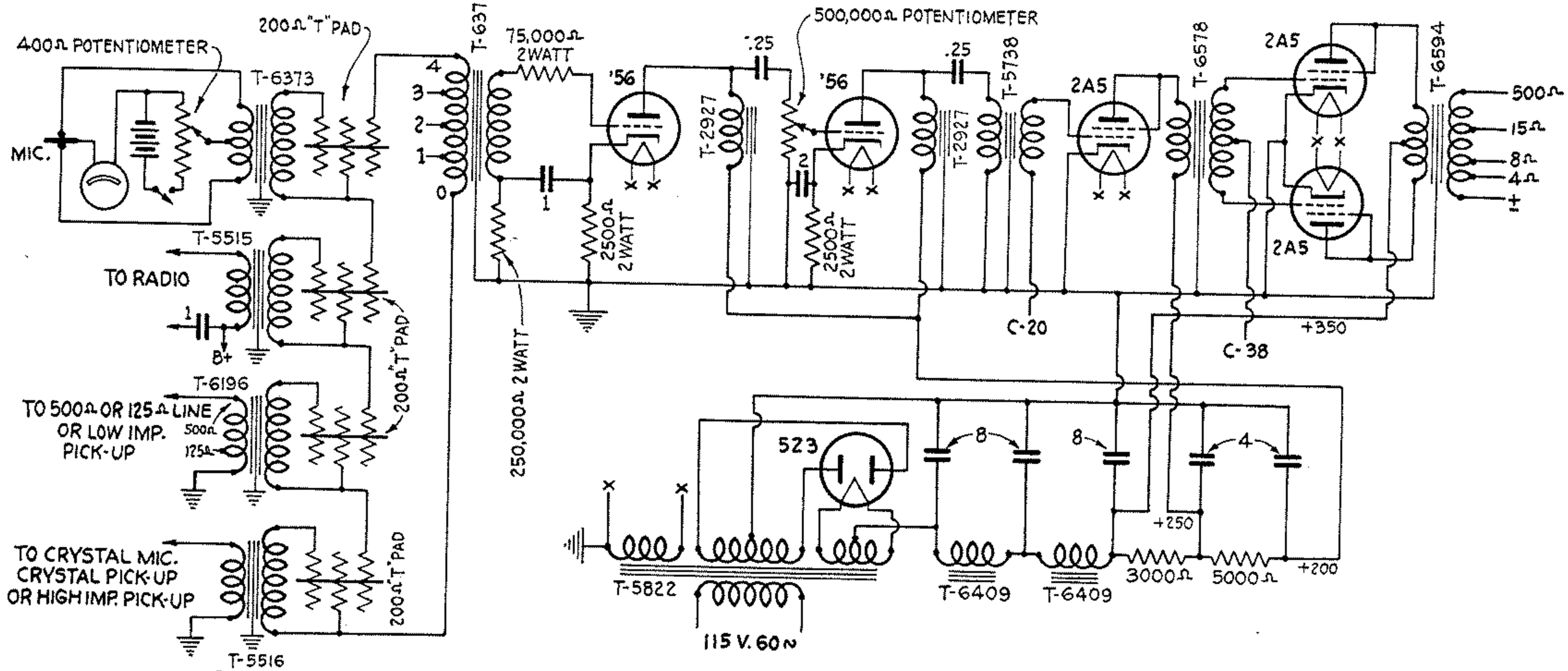
The second unit consists of the amplifier proper and a third unit consists of the power supply for the entire device. If the mixer circuit is not required for your particular application, it may be omitted and whatever type of pick-up device you desire may be connected to the grid of the 56 tube in the amplifier unit by means of a suitable transformer. The volume level from the input source in the mixer circuit is coupled to an Electrad 200-ohm T-pad by using 4 transformers, each of which has a 200-ohm secondary. Should some type of input device not shown in the circuit be desired, it is merely necessary to omit one of the transformers shown and replace it with the proper type of THORDARSON Transformer to match a 200-ohm line. These series connected units are then coupled into a T-6371 Transformer which has an 800-ohm primary. The secondary is coupled to the grid of the 56 tube in the pre-amplifier.

The amplifier unit has a main volume control in the grid circuit of the 56 tube. The plate circuit is coupled by the parallel feed method to the grid of the 2A5 driver which is triode connected. The D.C. current is carried by T-2927 Choke to the plate of the 56 tube, which increases the low frequency response appreciably. The 2A5 in the driver stage is operated in Class A and has a bias of 20 volts on the grid. The output transformer T-6594 has a 500-ohm secondary and also has four windings arranged for 15-8-4 ohms so it may be operated either into a 500-ohm line using matching transformers at the speaker position, or the voice coils of the speakers may be directly connected to the proper tap on the transformer in case the line is not required.

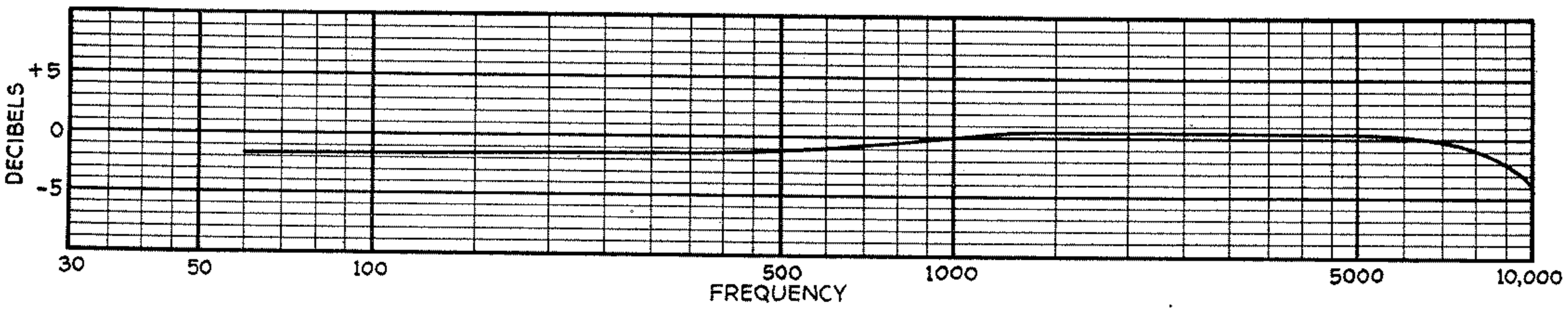
THORDARSON Equipment in 18-Watt Amplifier

T-6373	Microphone Transformer
T-5515	Input Transformer
T-6196	Input Transformer
T-6371	Input Transformer
T-5738	Interstage Transformer
T-6578	Interstage Transformer
T-6594	Output Transformer
T-5822	Combination Plate and Filament Transformer
T-5516	Input Transformer
T-2927	Impedance Coupling Choke
T-6409	Filter Choke

Type 2A5 Tube (Triode) Push-Pull Output Class A Amplifier



Frequency Characteristic Curve
Type 2A5 Tube (Triode) Push-Pull Output Class A Amplifier



160-Watt Transmitter « «

This 160-watt transmitter is particularly suited for phone transmission at 160 and 75 meters, and C.W. transmission at 80, 40, or 20 meters. Simplicity and low costs are its outstanding features.

The four 46 tubes in Class B used as modulators will deliver sufficient power for modulation of the final stage. This is quite a feature, inasmuch as two type 845 tubes used as Class A modulators and operated with a plate voltage of 1000, deliver only about 50 watts of audio power.

The careful selection of transformers and choke coils permits economical but efficient construction. In the audio section, filament voltage for all tubes, including the two type 83 rectifiers, is supplied by T-6094, a special filament transformer with three secondary windings. T-6095 is a special plate supply transformer designed to supply the required voltage and current to the speech amplifier and modulator tubes. Two type 83 tubes are used in a full wave rectifying circuit, the plates of each tube being connected by a

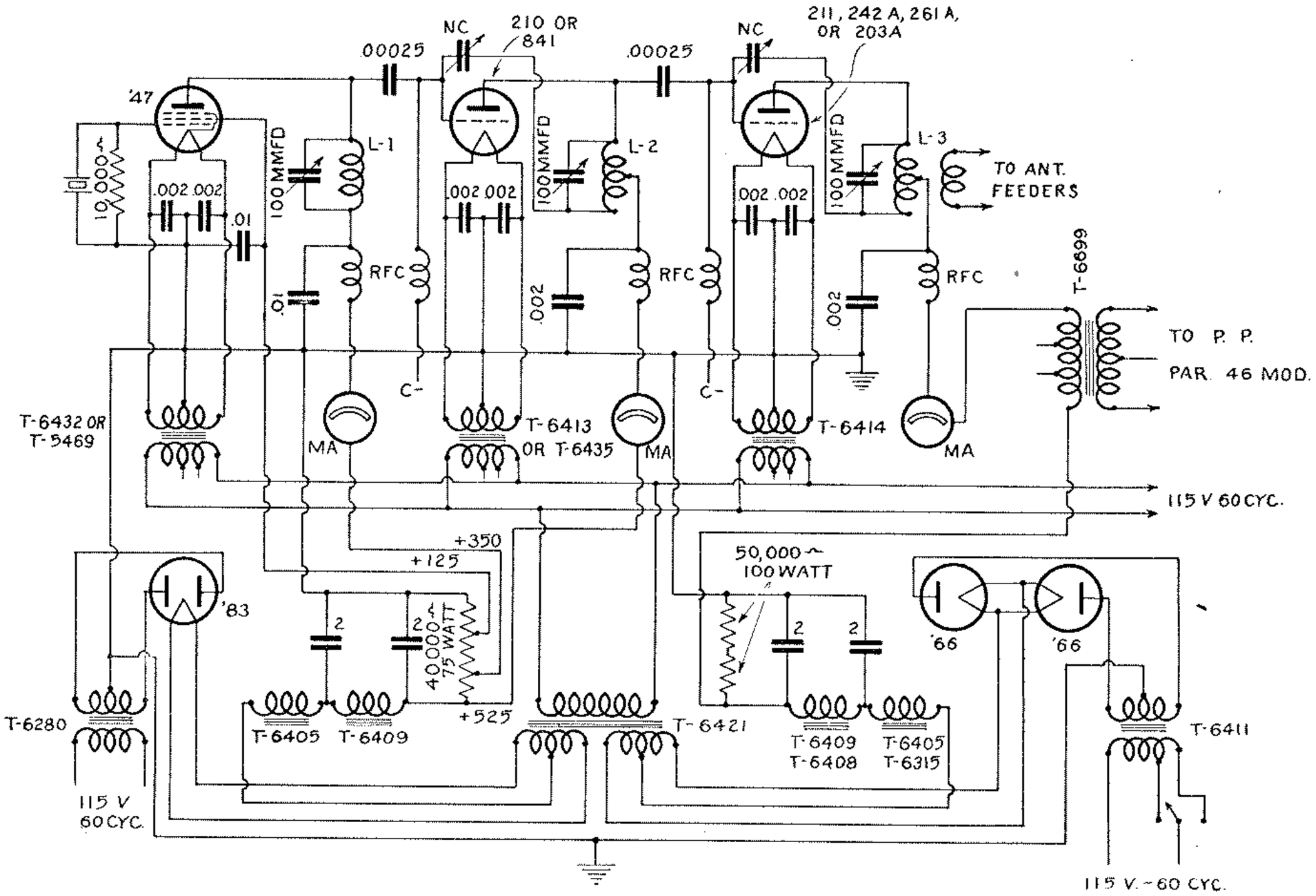
Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding			
				1700 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	3"	No. 16 Enameled	8	7"	2¾"	1"	½"
L2	3"	No. 14 Enameled	8	7¼"	3"	1"	½"
L3	4"	No. 14 Enameled	8	7¼"	T-7053	T-7052	T-7051

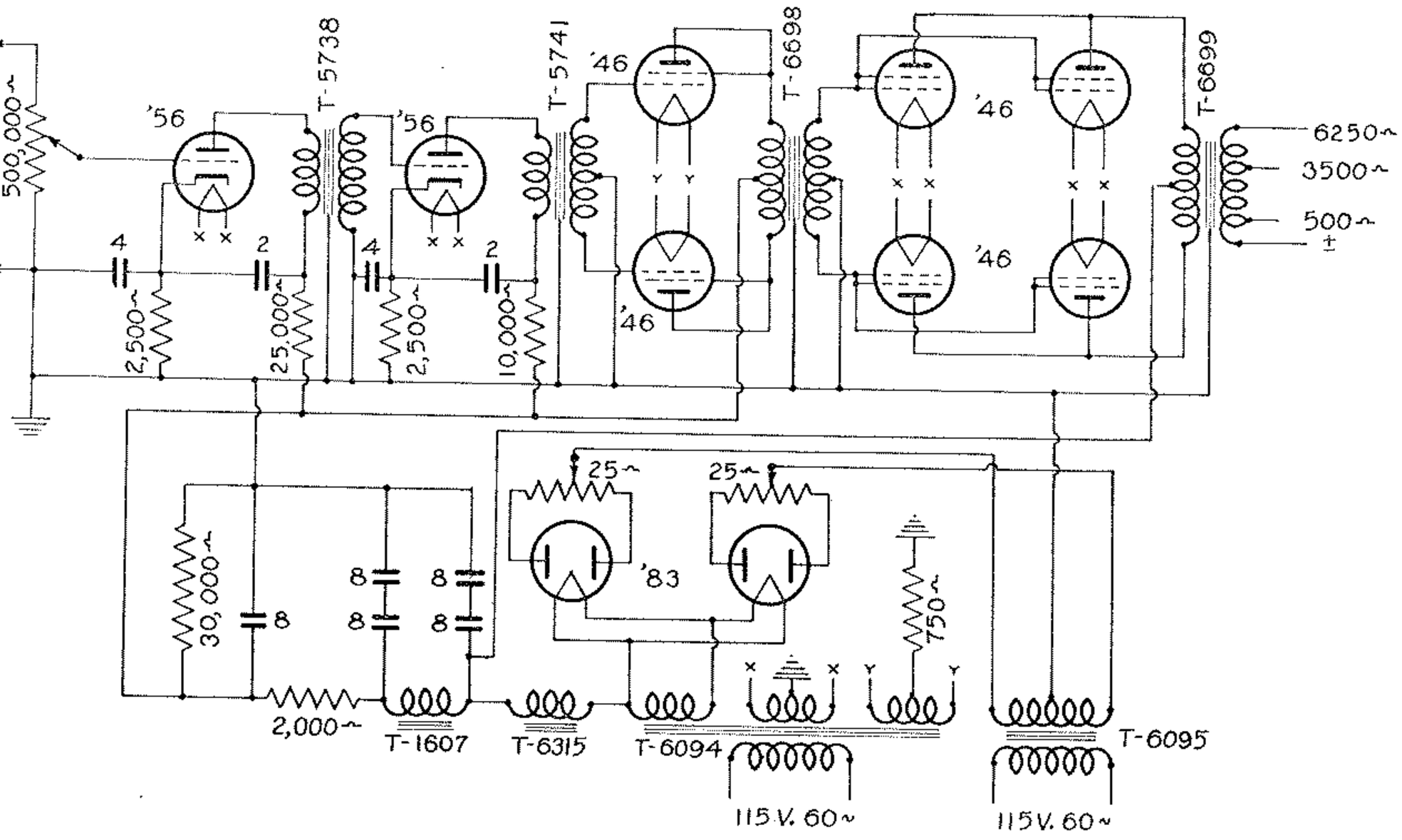
THORDARSON Equipment for Radio Frequency Stages

T-6411 Plate Transformer
T-6405 or T-6315 Input Chokes (two)
T-6409 or T-6408 Filter Chokes (two)
T-6421 Filament Transformer
T-6280 Plate Transformer
T-6432 or T-5469 Filament Transformers
T-6413 or T-6435 Filament Transformers
T-6414 Filament Transformer

Radio Frequency Stages and Power Supply



Modulator and Speech Amplifier



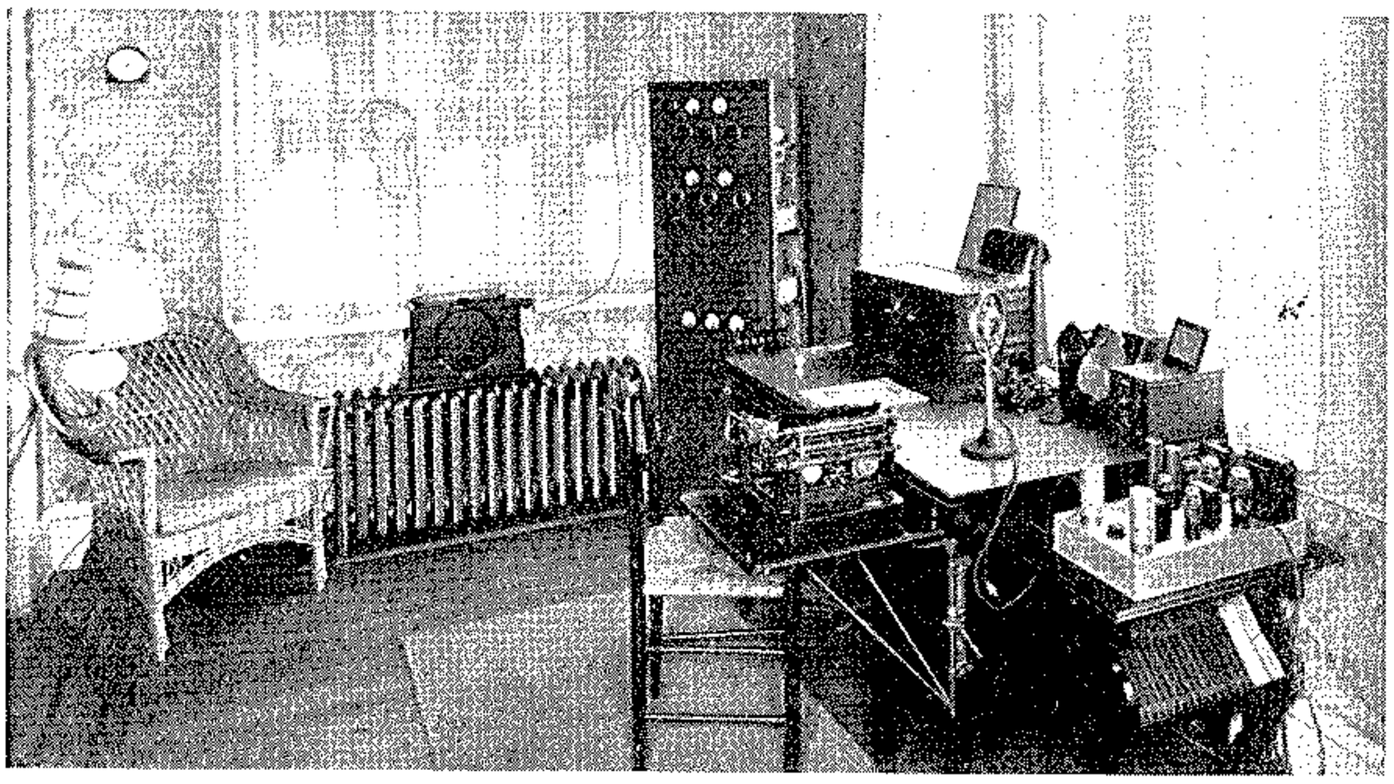
25-ohm potentiometer. This is necessary in order to adjust the load so the current is equal on each plate, as shown by the blue glow around the filaments. Once properly adjusted, the potentiometer needs no further attention. The arms of the 25-ohm resistors are at high voltage potential to ground and should be equipped with a bakelite or hard rubber knob for adjustment, and should be well insulated from ground. The filter consists of a T-6315 Input Choke, a T-1607 Filter Choke, a 2,000-ohm resistance, and five 8 mfd. condensers—two of these condensers in series across the line at each terminal of the filter choke to increase their breakdown voltage. Electrolytic condensers with leads are best for this use, although 2-mfd. 1000-volt filter condensers may be substituted if desired.

Separate filament transformers supply the '47 oscillator, the 210 buffer amplifier, and the 211modulated amplifier. A T-6411 Plate Supply Transformer furnishes 1000 or 1250 volts D.C., through the T-6405 and T-6409 Chokes, to the plate of the Class C amplifier tube. Choice of voltage is obtained by the use of a primary tap.

The plate supply for the oscillator and buffer amplifier consists of a T-6280 Plate Transformer, T-6405 and T-6409 Chokes, and T-6421 Filament Transformer. This transformer has two secondary windings: 5 volts at 3 amps. for the 83 rectifier; and 2.5 volts at 10 amps. for the two 866 rectifiers. The full output voltage of 525 is applied only to the plate of the 210 buffer amplifier, a tap being taken from the 40,000-ohm shunt resistance at 350 volts for the plate of the '47 oscillator and at 125 volts for the screen grid of the same unit. To match the 6250-ohm secondary of the modulation transformer, the tube in the final stage should be operated at 160 ma. with 1000 volts on the plate.

THORDARSON Equipment for Audio Frequency Stages

T-6095	Plate Transformer
T-6094	Filament Transformer
T-6315	Input Choke
T-1607	Filter Choke
T-6699	Class B Output Transformer
T-6698	Class B Input Transformer
T-5741	Push-Pull Input Transformer
T-5738	Interstage Transformer



Amateur Station W3CZW, operated and owned by Chas. C. Smith, Lancaster, Pa. This transmitter is THORDARSON equipped throughout.

30-Watt Phone or 100-Watt C. W. « « RK20 Transmitter

This transmitting circuit should be of particular interest to C.W. operators who occasionally desire to use phone. It has the advantage of requiring a minimum of parts and very little space, is easily adjusted, and very economical to operate.

Modulation is applied to the suppressor grids of the RK20 tubes, and only two stages of audio amplification are used.

The transmitter is even further simplified in that there are only two power supply systems for the entire unit. A plate voltage of 1000 or 1250 for the RK20 tubes is supplied from transformer T-6411 through chokes T-6315 and T-6408. Transformer T-6280 supplies 525 volts for the 865 buffer amplifier, 250 volts for the audio plates, 350 volts for the oscillator plate and the RK20 screen grids, and 125 volts for the oscillator and buffer screen grids. Filament voltage for all tubes is supplied by T-6421, T-6432, and T-6417.

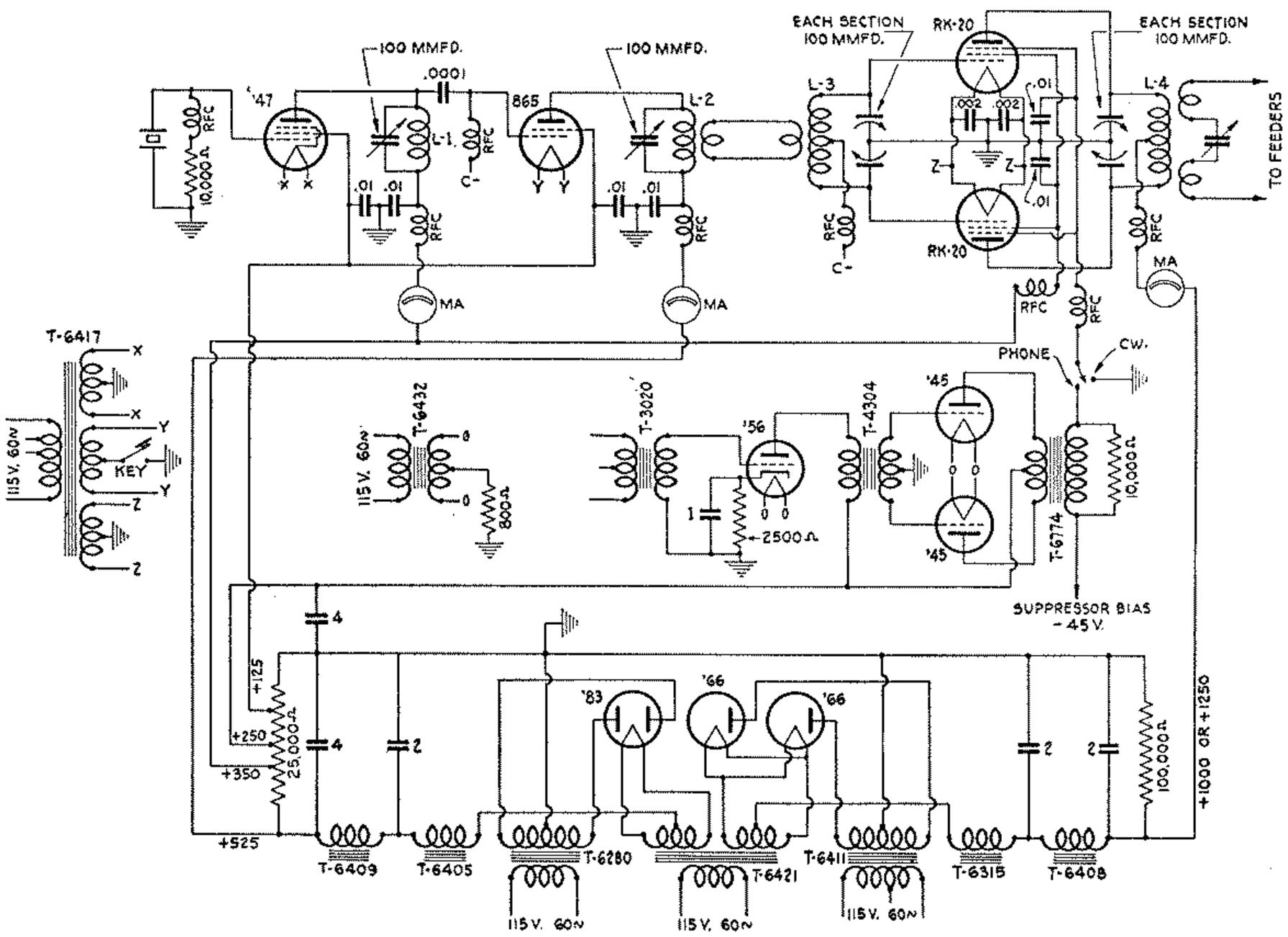
THORDARSON Equipment for RK20 Transmitter

T-6421	Filament Transformer
T-6411	Plate Transformer
T-6280	Plate Transformer
T-6315	Input Choke
T-6408	Filter Choke
T-6405	Input Choke
T-6409	Filter Choke
T-6417	Filament Transformer
T-6432	Filament Transformer
T-3020	Microphone Transformer
T-4304	Interstage Transformer
T-6774	Grid Modulation Transformer

Radio Frequency Coil Data

	Dia.	Wire Size	Turns Per In.	Length of Winding			
				1750 KC.	3500 KC.	7000 KC.	14,000 KC.
L1	3"	No. 14 Enameled	8	7"	2¾ "	1"	
L2	3"	No. 14 Enameled	8	7"	2¾ "	1"	½"
L3	3"	No. 14 Enameled	8	10"	4"	1½"	⅝"
L4	5"	No. 14 Enameled	8	5½"	T-7053	T-7052	T-7051

Link can be a split coil wound at each end of L2 and L3, and adjusted to supply maximum excitation to the RK20's at rated 865 plate current.



Transmitter Plate Transformers

for Matched Power Supplies

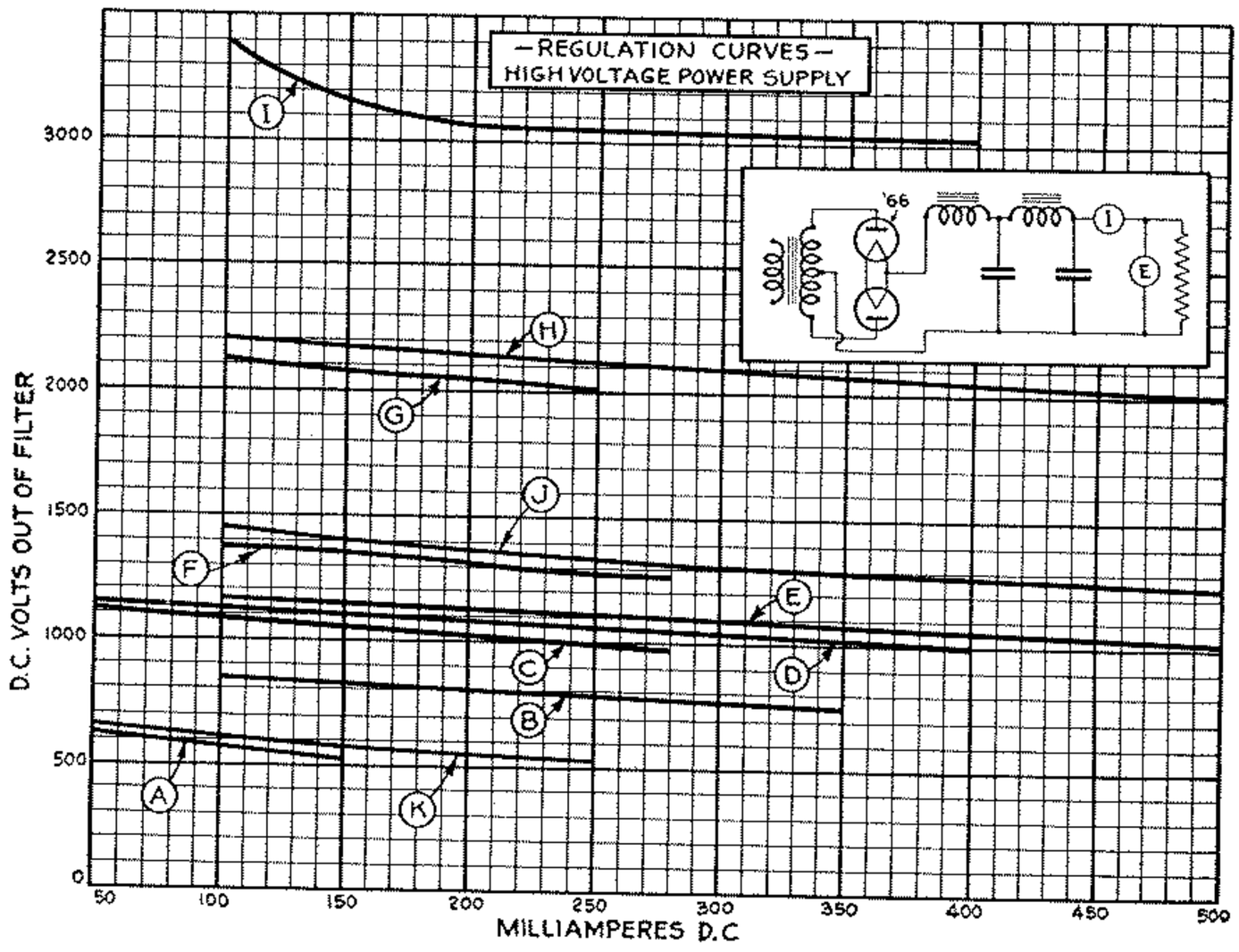
THORDARSON engineers have designed a line of complete power supplies to cover a wide range of output voltages and currents, so the constructor may definitely know the actual operating characteristics. The accompanying chart shows the value of all parts used, as well as actual measurements of output voltages, current, and ripple. In addition, complete regulation curves are shown for all units. THORDARSON Matched Power supplies are designed for maximum operating efficiency at minimum cost. Any deviation from the constants shown may adversely affect the regulation, ripple, or efficiency—or all.

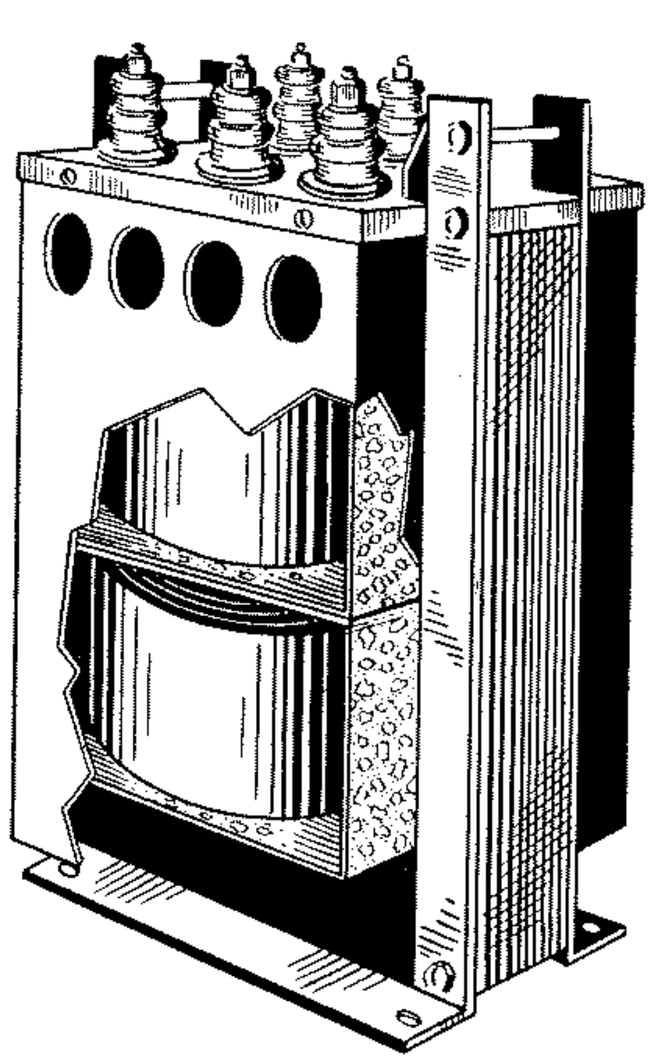
The effect of poor regulation in a Class B modulator supply is told on page 11. Good regulation is equally important for the r.f. supply of the transmitter, especially for grid or screen modulation, and for linear amplifiers or C.W. transmitters. For good regulation a well balanced design, using ample copper, core material, and insulation, is essential to a good transformer.

THORDARSON Matched Power Supply Systems

Voltage D.C.	Current MA.	Plate Transformer	Input Choke	Smoothing Choke	Percent Ripple Voltage	Curve	Rectifiers	Rectifier Filament Transformer
525	150	T-6280	T-6405	T-6409	.24	A	1— 83	T-6399
525	250	T-7041	T-6315	T-6408	.16	K	1— 83	T-6399
750	350	T-6412	T-6406	T-6407	.21	B	2—866's	T-6433
1000 / 1250	280	T-6411	T-6315	T-6408	.20	C / F	2—866's	T-6433
1000	400	T-5489	T-6316	T-6410	.31	D	2—866's	T-6433
1000	500	T-6282	T-6316	T-6410	.33	E	2—866's	T-6433
1000 / 1250	500	T-7033	T-6316	T-6410	.32	E / J	2—866's	T-6433
2000	250	T-6283	T-6315	T-6408	.16	G	2—866's	T-6433
2000	500	T-6284	T-6316	T-6416	.25	H	2—866's	T-6433
3000	380	T-6285	T-6406	T-6407	.15	I	2—866A's	T-6433

Note—D.C. working voltage of filter condensers should be 20% higher than the D.C. rating of the plate transformer.





"AIR-COOLED" Construction

The new "AIR-COOLED" construction of THORDARSON Heavy Duty Plate Transformers and Chokes has proved to be a development of the foremost importance.

A cut-away view of the T-6285 Plate Transformer is shown above. This construction allows unequalled facility for ventilation, and the entire weight of the transformer represents material actually used in the electrical circuits. No bulky castings or compound fillings add valueless weight.

THORDARSON "AIR-COOLED" Transformers and Chokes have been tested and approved under long periods of uninterrupted service in many government beacon and lighthouse installations where the most adverse atmospheric and climatic conditions are encountered.

Transmitter Plate Transformers

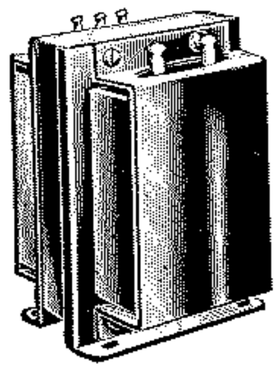


Fig. A

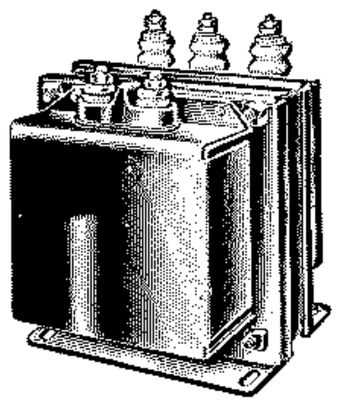


Fig. B

"AIR-COOLED" Construction

T-6280 525 volts D.C. at 150 ma. Sec. A.C. volts 725. 6x4¼x4". Wt. 9 lbs. Fig. A.

T-7041 525 volts D.C. at 250 ma. Sec. A.C. volts 725. 6¼x4⅜x5". Wt. 13½ lbs. Fig. A.

T-6412 750 volts D.C. at 350 ma. Sec. A.C. volts 980. 8x6¾x6¼". Wt. 25½ lbs. Fig. B.

T-6282 1000 volts D.C. at 500 ma. Sec. A.C. volts 1335. 8x6¾x8". Wt. 38 lbs. Fig. B.

T-6411 1000 or 1250 volts D.C. at 280 ma. Sec. A.C. volts 1290-1600. 8¼x6¾x7". Wt. 30 lbs. Fig. B.

T-7033 1000 or 1250 volts D.C. at 500 ma. Sec. A.C. volts 1333-1610. 8x6¾x8⅛". Wt. 38½ lbs. Fig. B.

T-6283 2000 volts D.C. at 250 ma. Sec. A.C. volts 2350. 8x6¾x8". Wt. 38 lbs. Fig. B.

T-6284 2000 volts D.C. at 500 ma. Sec. A.C. volts 2420. 13½x8x7¼". Wt. 59 lbs. Fig. C.

T-6285 3000 volts D.C. at 380 ma. Sec. A.C. volts 3630. 13½x8x7¾". Wt. 70 lbs. Fig. C.

T-5489 1000 volts D.C. at 400 ma. Sec. A.C. volts 1270. 7x8x7". Wt. 29 lbs. Fig. B.

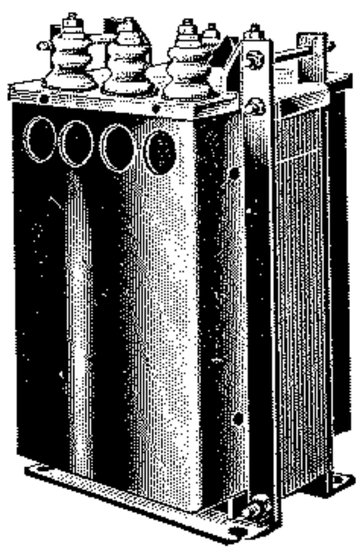


Fig. C

For Further Information and Additional Plate Transformers, see Page 2, Bulletin 343-A

Input and Smoothing Chokes « «

Mercury vapor rectifier tubes are essential to good regulation because of their constant voltage drop characteristic. In order to secure the maximum output with this type of rectifier, an input choke is required in the filter system. By properly designing this choke, its inductance can be made to vary inversely with the current, and as a result the regulation of the power supply will be materially improved. The minimum inductance must be high enough so a resonant condition does not occur in the circuit, since resonance will cause oscillation of the rectifier tubes and a general unstable and critical supply voltage.

The function of the second or filter choke is to filter and reduce the ripple voltage. Its resistance must be low for good regulation, but too much attention to this factor will result in a choke that is too bulky and costly for a given inductance.

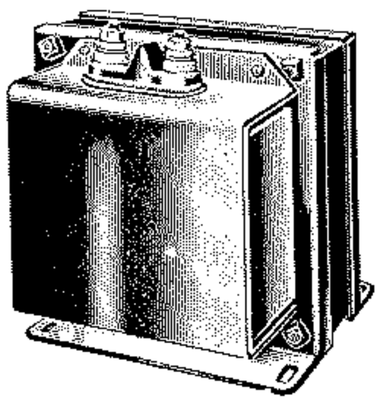


Fig. F

Input or Swinging Chokes

T-6405 Rated current 150 ma. Inductance 9.85 to 30.3 henries. 4x4x3½". Wt. 5 lbs. Fig. L.

T-6315 Rated current 280 ma. Inductance 12.3 to 19 henries. 6¾x4½x4⅜". Wt. 10 lbs. Fig. G.

T-6406 Rated current 380 ma. Inductance 10.4 to 19 henries. 6¾x5x4¾". Wt. 15 lbs. Fig. G.

T-6316 Rated current 500 ma. Inductance 8.2 to 17 henries. 6¾x4⅛x5". Wt. 20 lbs. Fig. G.

T-5517 Rated current 400 ma. Inductance 25.6 to 40 henries. 6⅞x6¾x6⅞". Wt. 29 lbs. Fig. F.

T-2353A Rated current 200 ma. Inductance 5 to 15 henries. 3x3¼x3¾". Wt. 3 lbs. Fig. L.

Smoothing or Filter Chokes

T-6409 has inductance of 19.7 henries at 150 ma. 4⅝x3⅞x4⅛". Wt. 6½ lbs. Fig. L.

T-6408 has inductance of 23.6 henries at 280 ma. 6¾x5x4⅜". Wt. 12 lbs. Fig. G.

T-6407 has inductance of 20 henries at 380 ma. 7½x6¾x6". Wt. 25 lbs. Fig. F.

T-6410 has inductance of 16.5 henries at 500 ma. 7½x6x6⅜" Wt. 25½ lbs. Fig. F.

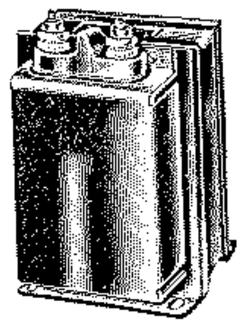


Fig. G

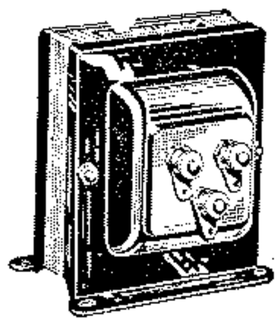


Fig. L

For Further Information and Additional Chokes, see Page 3, Bulletin 343-A

THORDARSON

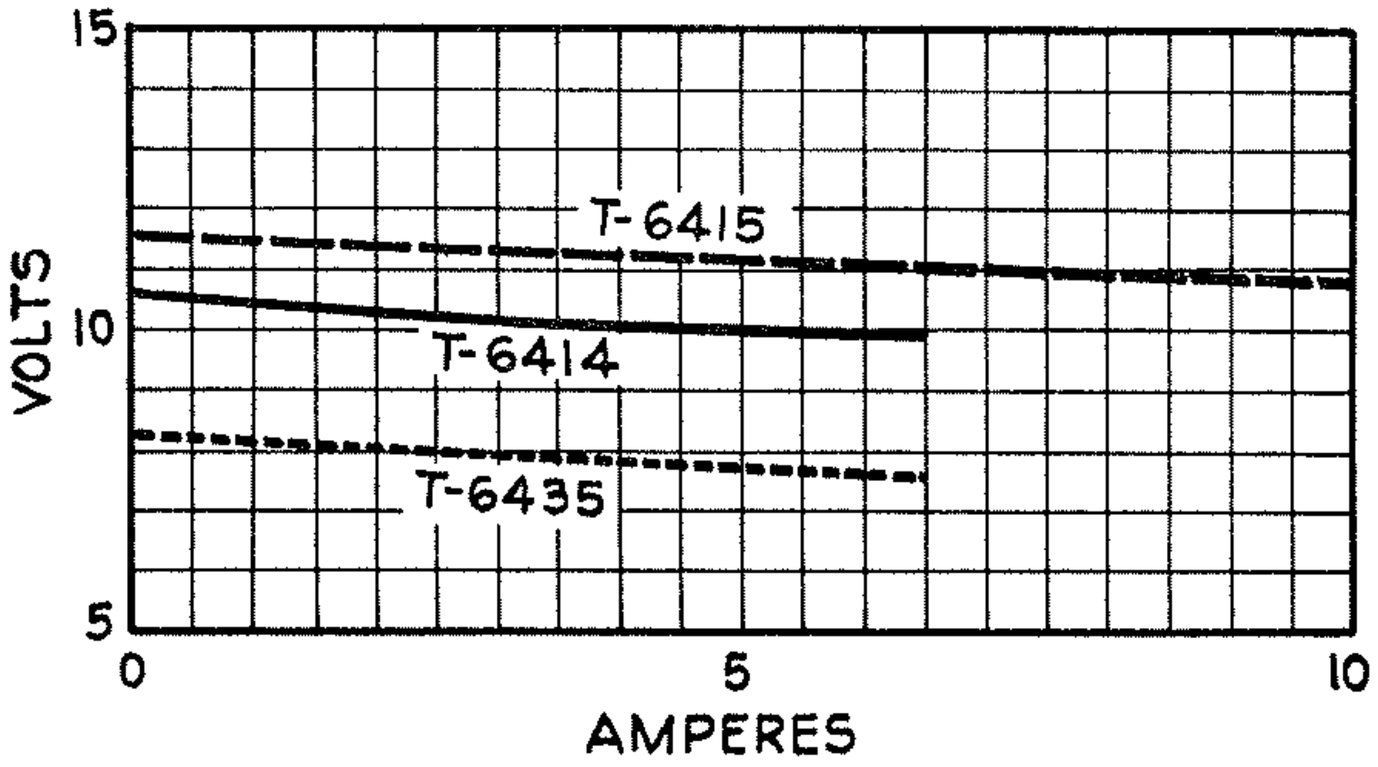
Transmitter Filament Transformers

In this greatly enlarged line of filament transformers, THORDARSON engineers have pioneered two new developments of importance to builders of transmitting equipment.

The types T-6416, T-6417, T-6421, T-5338, T-5466, T-6094 and T-7046 are multiple secondary transformers designed to supply current to a number of types of tubes, each usually requiring a separate transformer.

By designing THORDARSON Filament Transformers with heavier windings and more ample iron than is the usual practice, improved voltage regulation is obtained. These transformers can be operated over a wide range of currents without excessive voltage drop.

Filament Regulation Curves



Filament Transformers

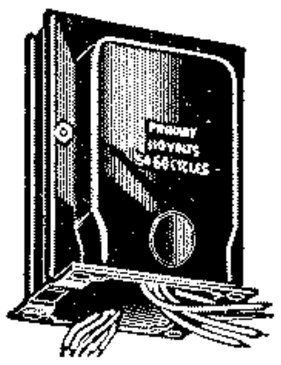


Fig. D

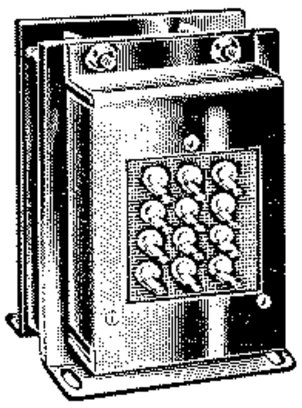


Fig. I

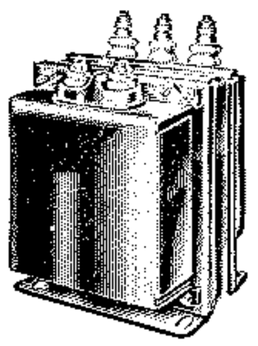


Fig. J

T-5338 has three windings: 5 V. at 3 amps. (c.t.), 2.5 V. at 8.75 amps., and 2.5 V. at 3.5 amps. 1600 V. insulation. Fig. D.

T-5455 provides 2.5 V. at 10 amps. 1600 V. insulation. Fig. R.

T-5466 has two c.t. sec. each 7.5 V. at 2.5 amps. 1600 V. insulation. Fig. M.

T-5469 provides 2.5 V. at 5 amps. 1600 V. insulation. Fig. M.

T-6094 has three sec. windings: 5 V. at 6 amps., 2.5 V. at 14 amps., and 2.5 V. at 3.5 amps. 1600 V. insulation. Fig. D.

T-6185 has single tapped sec. which supplies 6.3 V. at 2.5 amps., 2.5 V. at 3 amps., or 5 V. at 3 amps. 1600 V. insulation. Fig. M.

T-6399 provides 5 V. at 3 amps. 1600 V. insulation. Fig. L.

T-6413 has primary taps for 105, 110, and 115 V. Secondary 7.5 V. at 2.5 amp. c.t. 1600 V. insulation. Fig. L.

T-6414 has primary taps for 105, 110, and 115 V. Secondary 10 V. at 6.5 amp. c.t. 1600 V. insulation. Fig. L.

T-6415 has primary taps for 105, 110, and 115 V. Secondary 11 V. at 10 amp. c.t. 1600 V. insulation. Fig. L.

T-6416 has primary taps for 105, 110, and 115 V.; four c.t. sec.: 10 V. at 3¼ amps., 7.5 V. at 1¼ amps., 10 V. at 6½ amps., and 2.5 V. at 5 amps. 1600 V. insulation. Fig. I.

T-6417 has primary taps for 105, 110, and 115 V.; three c.t. sec.: 7.5 V. at 6½ amps., 7.5 V. at 4½ amps., and 2.5 V. at 4 amps. 1600 V. insulation. Fig. I.

T-6419 has sec. c.t. which supplies 11 V. at 15.5 amps. 1600 V. insulation. Fig. K.

T-6420 provides 5 V. at 25 amps. 10,000 V. insulation. Fig. J.

T-6421 provides 5 V. at 3 amps. and 2.5 V. at 10 amps. c.t. 3000 V. insulation. Fig. J.

T-6432 has primary taps for 105, 110, and 115 V. Provides 2.5 V. at 10 amps. c.t. 1600 V. insulation. Fig. L.

T-6433 has primary taps for 105, 110, and 115 V. Provides 2.5 V. at 10 amps. c.t. 7500 V. insulation. Fig. L.

T-6435 provides 7.5 V. at 6.5 amps. c.t. 1600 V. insulation. Fig. L.

T-7046 provides 5 V. at 3 amps., 5 V. at 3 amps., and 5 V. at 6 amps., all c.t. 5000 V. insulation. Fig. I.

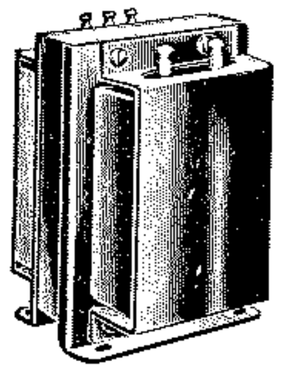


Fig. K

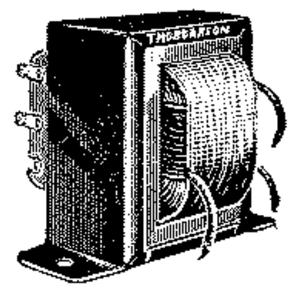


Fig. M

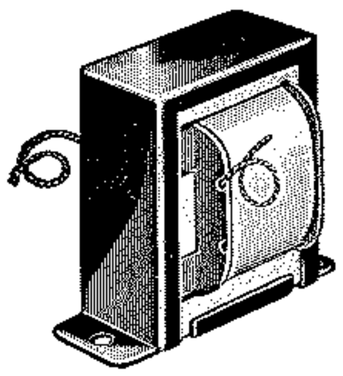


Fig. R

For Further Information see Page 3, Bulletin 343-A

Class B Audio Transformers « «

(See Page 11 for Information on Class B Modulation)

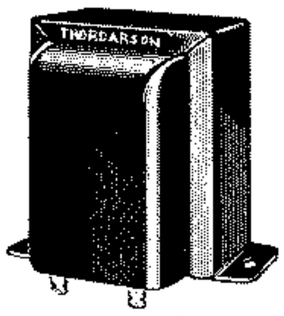


Fig. H

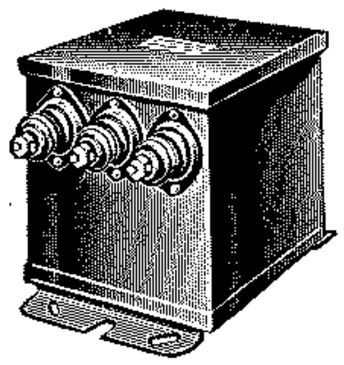


Fig. N

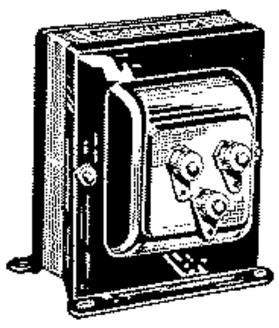


Fig. O

Input Transformers

T-6422 P.P. 245 or 2A3 to Class B 800, 830B, RK18, 801, etc. grids.

T-6265 500-ohm line to Class B 203A, 800, RK18, etc. grids. Fig. O.

T-6140 P.P. 2A3 tubes to Class B 203A or 211 grids. Split sec. for separate bias. Fig. O.

T-5251 P.P. 250 or 2A5 triodes to Class B 203A or 211 grids. Fig. O.

T-6734 500-ohm line to Class B push-pull parallel 203A or 211 grids. Fig. O.

T-6429 500-ohm line to Class B 204A grids. Fig. O.

T-6819 P.P. 845 Class A to Class B 204A grids. Fig. O.

T-5289 Single 46 or 59 Class A to Class B 46 or 59 grids. Fig. O.

T-6778 Same as above, but is for sub-panel wiring. Fig. H.

T-6698 P.P. 46 or 59 Class A to P.P. par. Class B 46 or 59. Fig. H.

T-5100 P.P. 45 to Class B 210 or 801 grids. Fig. O.

T-6747 Single 53 or 6A6 Class A to Class B 53 or 6A6 grids. Fig. N.

T-6750 89 or 41 Class A to Class B 79, 53, or 6A6 grids. Fig. N.

T-5463 Single 30 to Class B 19 grids. Fig. H.

Output Transformers

T-6423 800, RK18, etc., to 5000 or 20,000-ohm load. Max. D.C. thru sec., 200 ma. at 5000 ohms or 100 ma. at 20,000 ohms. Fig. N.

T-6424 203A or 211 to 2500 or 10,000-ohm load. Max. D.C. thru sec., 400 ma. at 2500 ohms or 200 ma. at 10,000 ohms. Fig. N.

T-6735 P.P. par. 203A to 4000-ohm load. Max. D.C. thru sec., 500 ma. Fig. F.

T-6430 204A to 5000-ohm load. Max. D.C. thru sec., 500 ma. Fig. C.

T-6426 46 or 59 to 5000 or 10,000-ohm load. Max. D.C. thru sec., 100 ma. Fig. O.

T-6699 P.P. par. 46 or 59 to 500, 3500, or 6250-ohm load. Max. D.C. thru sec., 215 ma. Fig. N.

T-6425 210 to 5000 or 10,000-ohm load. Max. D.C. thru sec., 200 ma. Fig. O.

T-7084 801 to 4510, 6250, or 12,500-ohm load. Max. D.C. thru sec., 200 ma. Fig. N.

T-6759 53, 6A6, or 79 to a 3000-ohm load. Max. D.C. thru sec., 100 ma. Fig. H.

T-6769 19 to 2700-ohm load. Max. D.C. thru sec., 50 ma. Fig. H.

Coupling Transformers for Suppressor or Control Grid Modulation

T-6773 Single 46 or 59 Class A to control or suppressor grid. Fig. O.

T-6774 P.P. 45 or 2A3 to control or suppressor grid. Fig. O.

For Complete Information on THORDARSON Audio Transformers see Bulletin 343-A

Class B Modulator Systems

Type Tube	Driver	Input Trans.	Output Trans.	Modulator Filament Trans.	Modulator Plate Trans.	Swinging Choke	Rectifier Tubes	Rectifier Filament Trans.	Watts Output
One 19	1-30	T-5463	T-6769	2V.D.C.	180V.D.C.				2
One 53 or 6A6	1-53 1-89	T-6747 T-6750	T-6759	T-5469 T-6935	T-6935	T-2353A T-6749	1-83	T-6399 T-6935	10
Two 46's or 59's	1-46 or 59	T-5289 T-6778	T-6426	T-5469 T-5338 etc. T-5455	T-5303	T-2353A	1-83	T-6399 T-5338	20-30
Four 46's or 59's	2-46's or 59's	T-6698	T-6699	T-6094 T-5338	T-6095		2-83's	T-6094	40-60
Two 210's	2-45's	T-5100	T-6425	T-6413	T-5140 T-6280	T-6405	1-83	T-6399	30-35
Two 801's	2-45's 2-2A3's	T-6422	T-7084	T-6413	T-7041 T-6412	T-6315 T-6406	1-83 2-866's	T-6399 T-6433	40-50 60-75
Two 800's	2-45's 2-2A3's	T-6422	T-6423	T-6435	T-6411 T-7033	T-6315 T-6316	2-866's	T-6433	100-120
Two RK18's	2-45's 2-2A3's	T-6422	T-6423	T-6435	T-6411 T-7033	T-6315 T-6316	2-866's	T-6433	100-120
Two 203A's	2-2A3's 2-250's	T-6140 T-5251	T-6424	T-6414	T-6411 T-7033 T-5489	T-6315 T-6316 T-5517	2-866's	T-6433	200-250
Four 203A's	2-250's 2-845's	T-5251 T-6819	T-6735	2-T-6414	T-6282 T-7033	T-6316	2-866's 2-872's	T-6433 T-6420	400-500
Two 204A's	2-845's	T-6429 T-6819	T-6430	T-6415	T-6284	T-6316	2-866's 2-872's	T-6433 T-6420	500-600

TRANSMITTING TUBE CHART

Type	Purpose	Fil. Volts	Fil. Amps.	Class C R. F. Plate Modulated: Plate Volts	Plate Current Ma.	Screen Volts	Grid Bias Volts	Class C R. F. C. W.: Plate Volts	Plate Current Ma. Max.	Screen Volts	Grid Bias Volts	Class B Audio: Plate Volts	Max. Signal Plate Current Per Tube Ma.	Grid Bias Volts	Plate to Plate Load Ohms	Peak Power Output Watts (2 tubes)
203 A	Osc., R.F. Amp., Class B Mod.	10	3.25	1000	175		-135	1250	175		-125	1000	160	- 35	6900	200
												1250		- 45	9000	260
204 A	Osc., R.F. Amp., Class B Mod.	11	3.85	2000	275		-250	2500	275		-175	2000	250	- 60	8800	600
210	Osc., R.F. Amp., Class B Mod.	7.5	1.25	500	50		-135	600	70		-112	500	60	- 57	8000	28
211	Osc., R.F. Amp., Class B Mod.	10	3.25	1000	175		-260	1250	175		-225	1000	160	- 77	6900	200
												1250		-100	9000	260
800	Osc., R.F. Amp., Class B Mod.	7.5	3.25	1000	80		-200	1250	80		-175	1000	80	- 55	12,500	100
												1250	65	- 70	21,000	106
801	Osc., R.F. Amp., Class B Mod.	7.5	1.25	500	60		-190	600	70		-150	500	65	- 60	8000	36
												600		- 75	10,000	45
825	High Frequency Osc. and R.F. Amp.	7.5	3.25	1000	80		-150									
830	Osc., R.F. Amp.	10	2.15	750	110		-180	750	110		-150					
830 B	Class B Mod.	10	2					1000	150		- 70	1000	140	- 33	10,000	190
841	Osc., R.F. Amp., Class B Mod.	7.5	1.25	350	60		- 36	450	60		- 32	425	60	- 5	7000	28
849	Osc., R.F. Amp., Class A or B Mod.	11	5	2000	350		-350	2500	350		-300	2000	325	-105	7040	870
												2500	275	-130	11,480	920
852	Osc., R.F. Amp.	10	3.25	2000	85		-500	3000	150		-600					
860	Screen Grid R.F. Amp.	10	3.25	2000	85	300	-250	300	150	300	-150					
865	Screen Grid R.F. Amp.	7.5	2	500	60	125	-150	750	60	125	- 80					
46	R.F. Amp. Freq. Doubler	2.5	1.75	400	40		- 35	400	40		- 25	400	60	0	5800	20
53	Twin Amp. or Class B Mod.	2.5	0.2	300	100		- 40					300	50	0	10,000	10
59	Osc., R.F. Amp., Class B Mod.	2.5	0.2	400	50	125 As osc.	- 35	400	40		- 25	400	60	0	6000	25
6A6	Twin Amp. or Class B Mod.	6.3	0.8	300	100		- 40					300	50	0		10
79	Twin Amp. or Class B Mod.	6.3	0.6	250	100		- 40					250	25	0	14,000	8
19	Twin Amp. or Class B Mod.	2	0.26	135	50		- 10					135	35	0	10,000	2.1
RK18	Osc., R.F. Amp., Class B Mod.	7.5	2.5	750	85		-150	900	150		- 85	1000	80	- 50	12,000	70

MERCURY VAPOR RECTIFIERS

Type	Purpose	Fil. Volts	Fil. Amps.	Max. Peak Inv. Volts	Max. Peak Current Amperes
83	Full-Wave Rectifier	5	2	1400	.800
866	Half-Wave Rectifier	2.5	5	7500	.600
866 A	Half-Wave Rectifier	2.5	5	10,000	.600
872	Half-Wave Rectifier	5	10	7500	2.5
872 A	Half-Wave Rectifier	5	6.75	10,000	2.5

HIGH VACUUM TYPE RECTIFIERS

Type	Purpose	Fil. Volts	Fil. Amps.	A-C Plate Voltage R.M.S.	D-C Output Current Amperes
80	Full-Wave Rectifier	5	2	350	125
5Z3	Full-Wave Rectifier	5	3	500	250
281	Half-Wave Rectifier	7.5	1.25	700	85
84	Full-Wave Rectifier	6.3	.5	225	50

Wattage Input and Load « « Impedance Chart

This chart is designed to enable the user to determine without computation the wattage input to any tube or tubes and the load impedance which any modulated stage presents to the modulator. The latter is of special importance, since improper matching of the modulated tube may be the cause of low audio output, high harmonic distortion, or both.

As a general rule, when using a Class B or Class AB audio system, if the impedance of the modulated tube is higher than that for which the coupling transformer is designed, the harmonic distortion will be low, but the power output will also be reduced. If the load impedance is low, the harmonic distortion will be greater, as will be the power output.

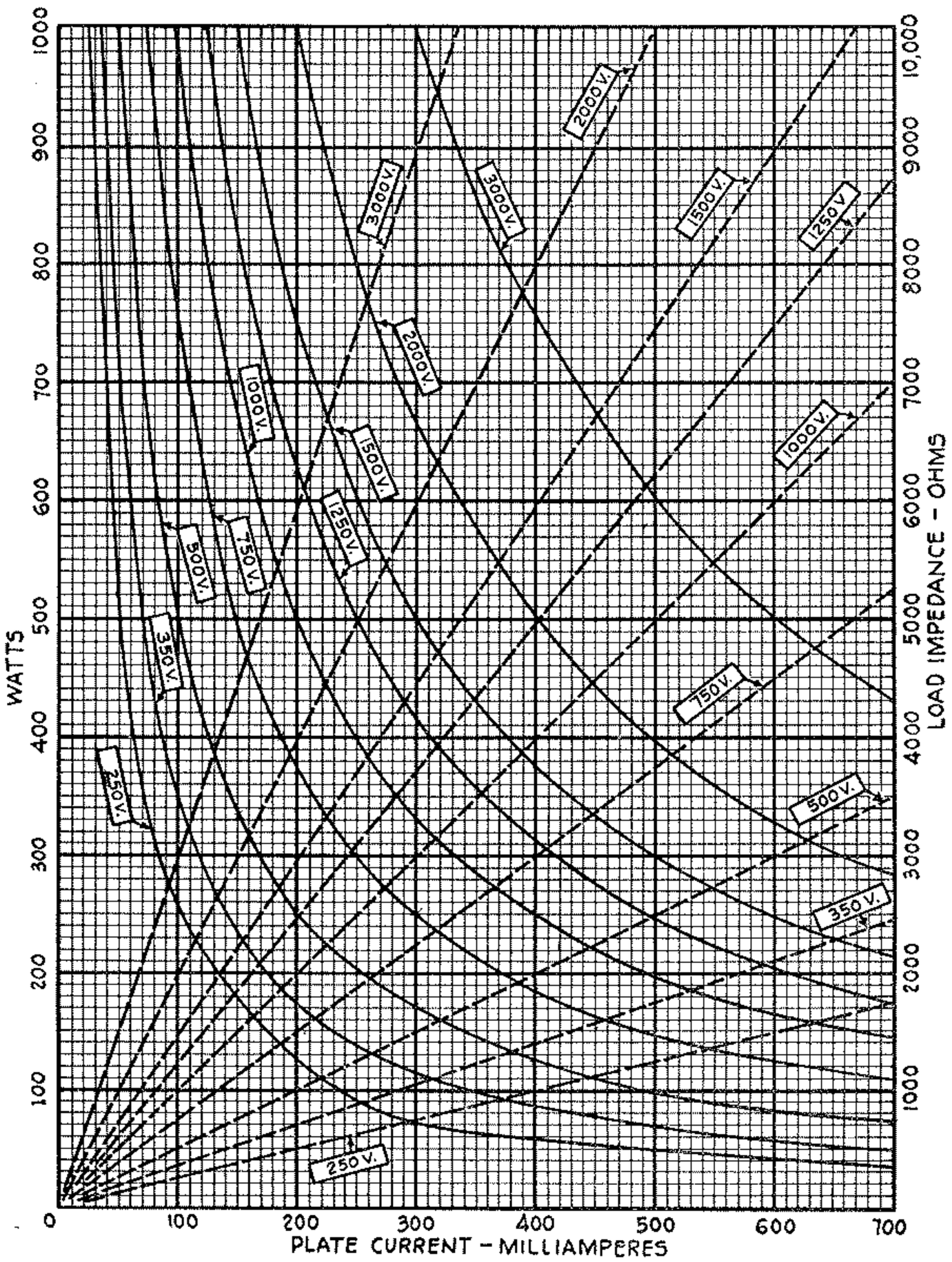
The modulated tube acts as a resistance which can be varied by changing either the plate voltage and current, or both. Of course, the rating of the tube should not be exceeded. Remember that the audio power is added to the D.C. plate input power, and that if a tube is operated at its maximum capacity when unmodulated, it may fail when modulation is applied.

Two graphs are combined on this page. The straight dotted lines are a family of curves showing input wattage. The proper plate voltage line is followed until it crosses the vertical line representing plate current, and the input wattage may be read directly from the left margin.

The load impedance is shown as a family of curved solid lines. The proper voltage curve is followed until it intersects the required vertical plate current line, and load impedance is read from the right margin.

By placing a ruler horizontally across the chart, the operating conditions to secure that load may be determined by reading the plate current at the bottom of the page directly under the intersection with the various plate voltage lines.

Assume that we wish to use a pair of 03A's Class B to modulate a transmitter with 852's in the output. The modulator unit is capable of supplying more than the 200 watts of audio power required to fully modulate 400 watts input. The secondary of the output transformer T-6424 is matched to a 10,000-ohm load with the secondaries in series, or to 2500 ohms with the parallel connection. Following the horizontal line of the chart marked 10,000 ohms across until it intersects



_____ Input Wattage _____ Load Impedance

the proper voltage line (in this case the 852's are operating at 2000 volts), we find the proper plate current at the bottom of the chart to be 200 ma. Now following the 2000 volt dotted line on the voltage chart until it intersects the 200 ma. line, the desired plate input is found to be 400 watts. On checking the specifications of the T-6424 Output Transformer, the secondary is designed to carry 200 ma. plate current, so the proper operation of the Class C amplifier is 2000 volts at 200 ma. The current can be varied by adjustment of the load and bias to secure this optimum condition.

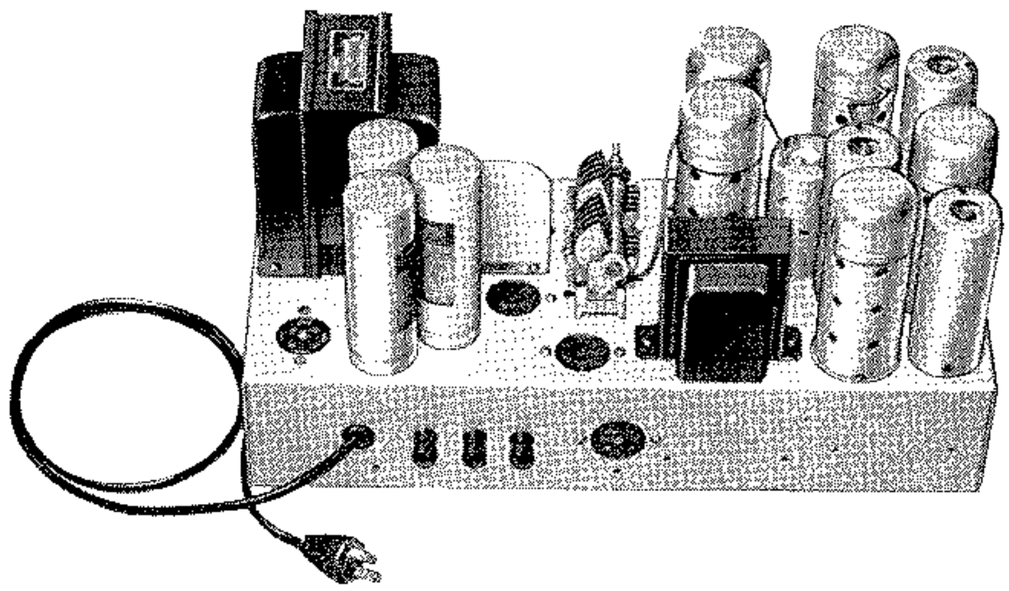
The ALL-STAR Receiver

Continuous Band-Spread All-Wave Superheterodyne

Designed by eight leading parts manufacturers, the ALL-STAR All-Wave Superheterodyne embodies many unusual features. The latest type tubes are used, including the 2A7 oscillator and first detector, 58 first and second i.f., 56 second detector, 2A5 power output pentode, and 80 rectifier.

Using the standard parts for which the set has been designed, the ALL-STAR covers the entire tuning range from 10 to 500 meters without any skips.

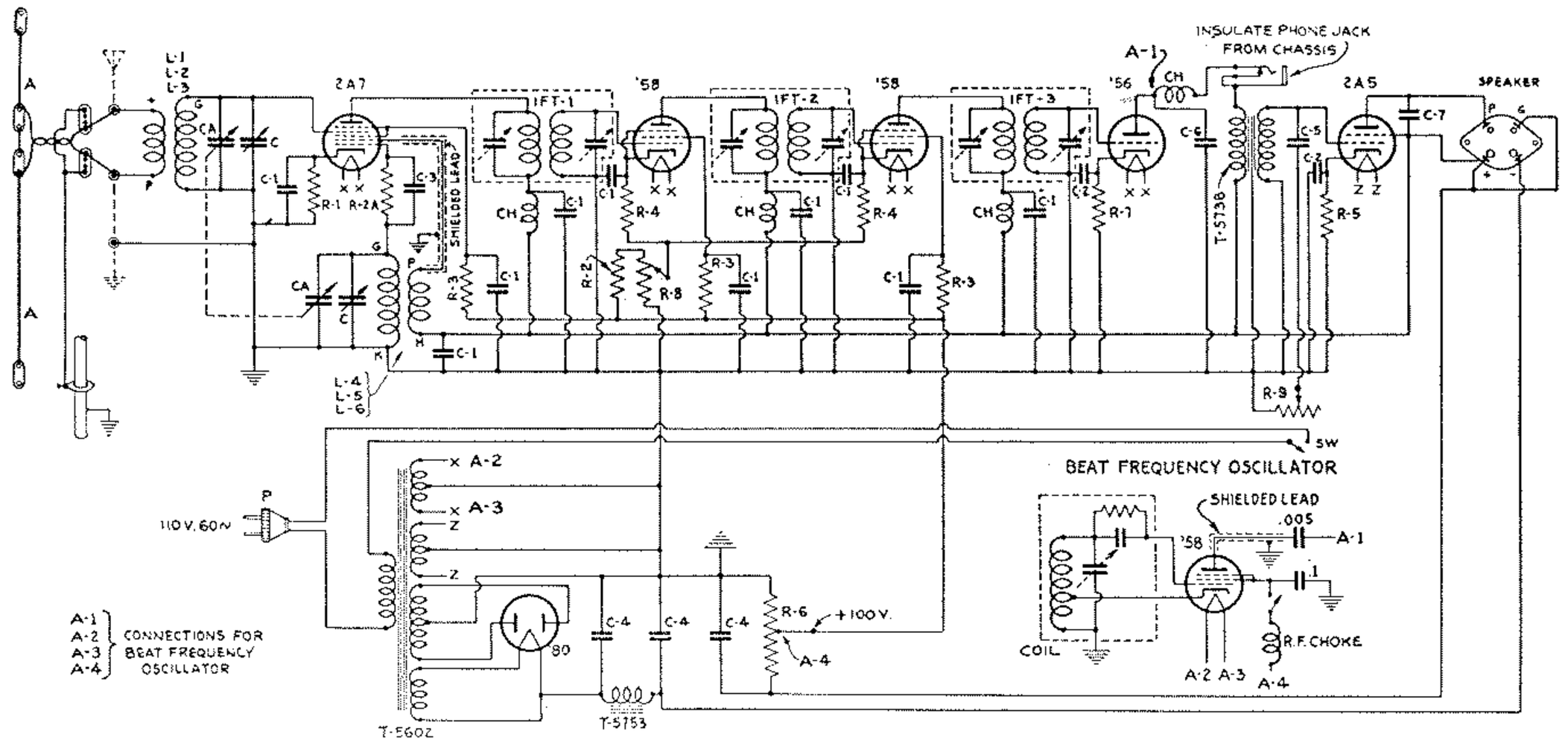
The receiver has continuous band-spread for easy separation of stations in the crowded amateur bands. A beat frequency oscillator is an integral part of the receiver for C.W. signal reception. The foundation unit, which includes drilled chassis and panel, as well as complete instructions, makes it possible to assemble and wire the receiver in a very short time.



Rear view of the ALL-STAR Receiver with front panel removed

For further information on the ALL-STAR Foundation Unit, write your supply dealer.

Wiring diagram and parts list of the ALL-STAR Receiver

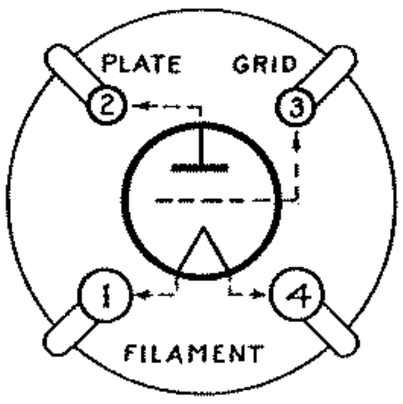


L-1 Meissner 20 Meter Detector Coil
L-2 Meissner 40 Meter Detector Coil
L-3 Meissner 80 Meter Detector Coil
L-4 Meissner 20 Meter Oscillator Coil
L-5 Meissner 40 Meter Oscillator Coil
L-6 Meissner 80 Meter Oscillator Coil
C 140 MMFD. Hammarlund Star Cond.
CA 35 MMFD. Hammarlund Dual Cond.
C-1 0.1 MFD. Cornell-Dubilier Cond.
C-2 1.0 MFD. Cornell-Dubilier Cond.
C-3 .0001 MFD. Cornell - Dubilier Cond.
C-4 8 MFD. Cornell-Dubilier Cond.
C-5 .003 MFD. Cornell - Dubilier Cond.
C-6 .0005 MFD. Cornell - Dubilier Cond.
CH Meissner 16 MH. R.F. Choke
IFT Meissner 370 KC. I.F. Transformer
C-7 .01 MFD. Cornell-Dubilier Cond.
R-1 500 ohm Ohmite Resistor
R-2 10,000 ohm Ohmite Resistor
R-2A 25,000 ohm Ohmite Resistor
R-3 5000 ohm Ohmite Resistor
R-4 1000 ohm Ohmite Resistor
R-5 500 ohm Ohmite Red Devil Resistor
R-6 25,000 ohm Ohmite 55-watt Voltage Divider with Two Clips
R-7 50,000 ohm Ohmite Resistor
R-8 10,000 ohm Volume Control—Potentiometer Type
R-9 100,000 ohm Tone Control—Potentiometer Type

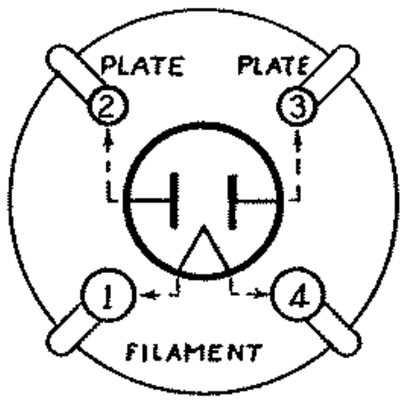
TUBE SYMBOLS AND SOCKET CONNECTIONS

(Bottom View)

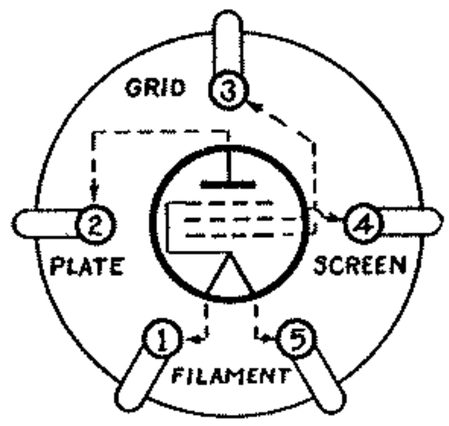
'10, '45, '30, 2A3, 250



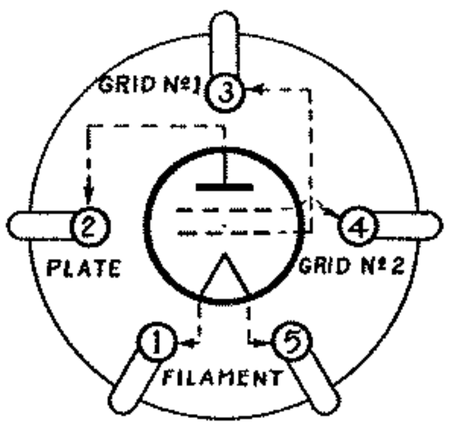
'80, '82, '83, 5Z3



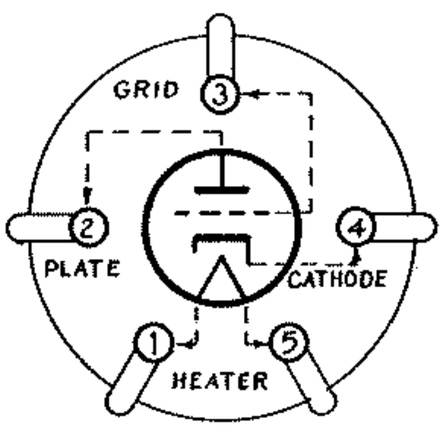
'47, '33



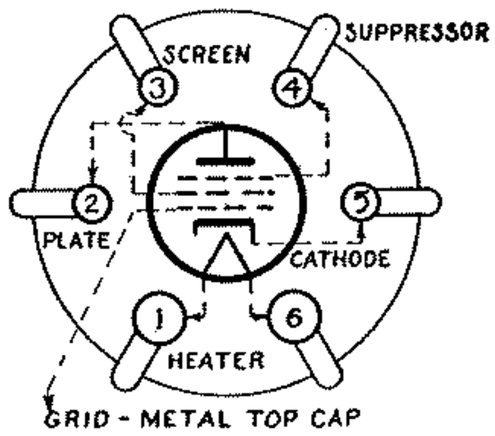
'46, '49



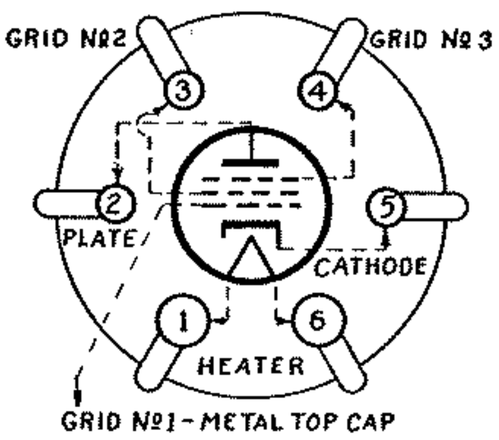
'27, '37, '56, '76



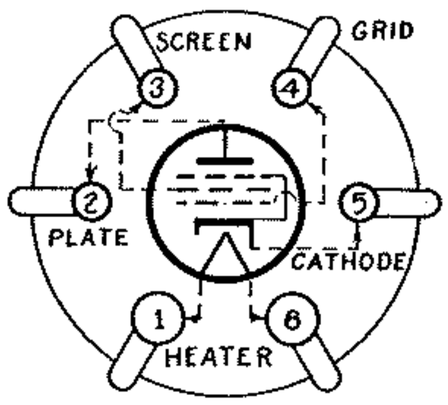
6C6, 6D6, '57, '58, '77, '78



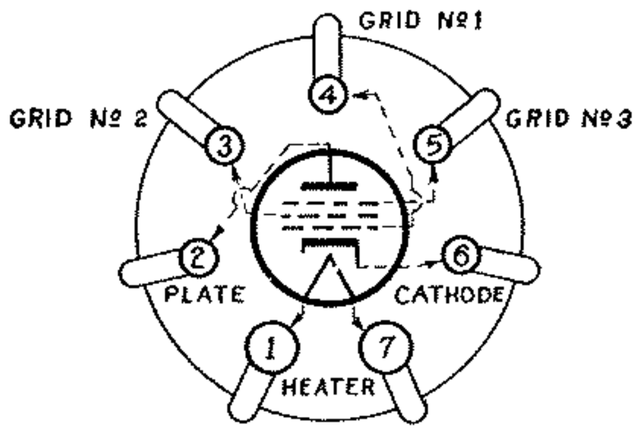
'89



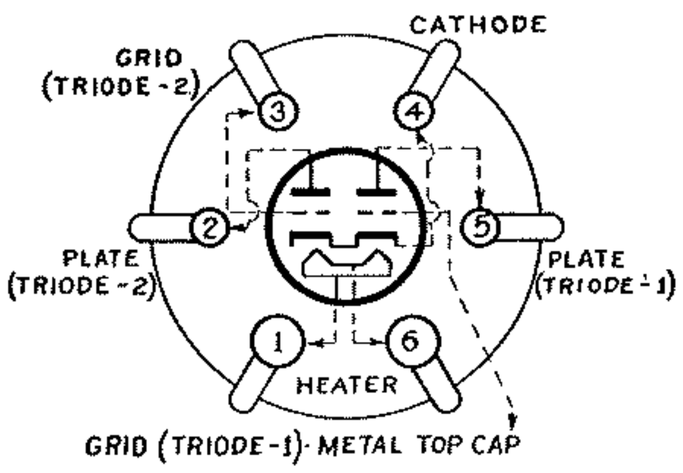
2A5, '41, '42, '43



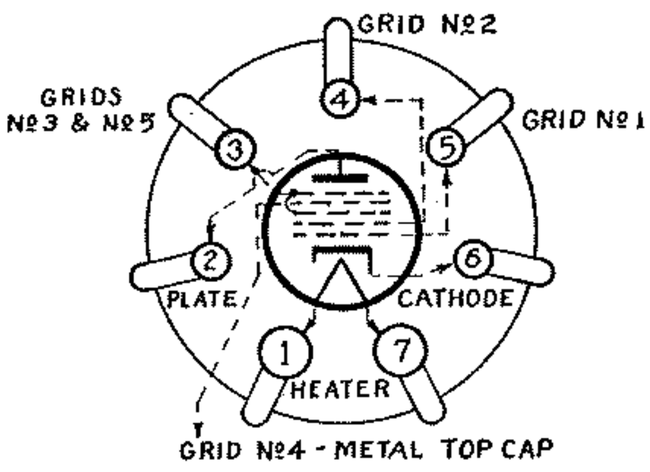
'59



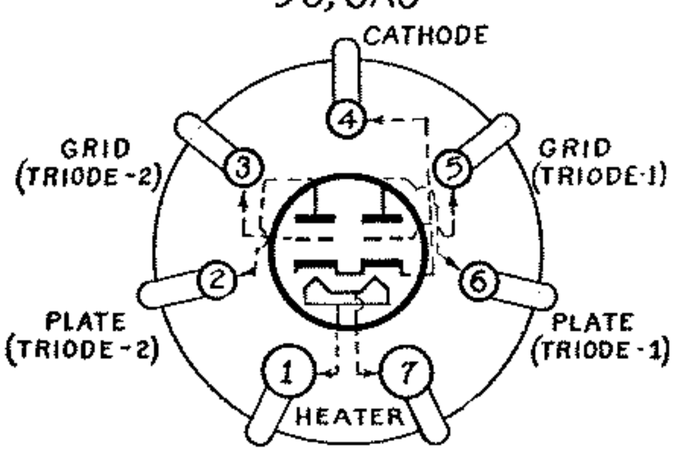
'79



2A7, 6A7



'53, 6A6



THORDARSON ELECTRIC MFG. CO.

500 W. HURON ST. CHICAGO, ILL.

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